Canadian Transport Commission
Commission canadienne des transports

Research Branch
Direction de la recherche

RESEARCH SEMINAR SERIES

Spring 1983
Volume 9

Research Seminar Series

Richard H. Fosbrooke
Series Coordinator

Hope Dempsey
Editor, English Version

Louise Lambert
Pierre Levasseur
Editors, French Version

CANADIAN TRANSPORT COMMISSION
Research Branch
Spring 1983
Volume 9

Version française disponible sous le titre
"Série de séminaires de recherche",
volume 9, printemps 1983

First Printing, March 1985

Canadian Transport Commission
15 Eddy St., 15th floor, Ottawa-Hull K1A 0N9

©Minister of Supply and Services Canada 1983
Catalogue Number TT71-21/1983-1E
ISBN 0-662-13430-3
ISSN 0229-7574

Printed in Canada

Commission canadienne des transports | Canadian Transport Commission

FOREWORD

This is the text of five seminars that were presented to the Commissioners and staff of the Canadian Transport Commission during the Spring of 1983. The Commission makes these papers available as a further contribution to the continuing discussion of the development of transportation policy and regulation in Canada.

The seminar presented by David W. Gillen, Professor at Wilfrid Laurier University, and Tae H. Oum, Professor at the University of British Columbia, addresses one of the major topics in the on-going discussion of airline regulation/de-regulation. By estimating an airline cost function and examining its structure, they explore how the cost of an airline operation in Canada varies with respect to the scale of its operation, nature of its network and markets, and the mixture of its output types.

The address by Kevin B. Doyle, President, and William A. Tett, Vice-President, Sultran Ltd. presents a valuable perspective on the transportation issues affecting Western Canada as they relate to the operations of an important bulk shipper. In particular, the background of the Canadian sulphur industry and its position in world markets is described within the context of some recommendations dealing with transportation policy and its administration which would afford western shippers a better advantage to exploit future market opportunities.

David McQueen, Professor at Glendon College, York University, makes a very personal statement on the possible directions for common-carrier passenger transport in Canada. In reflecting on the economics relevant to this issue, he suggests a number of less expensive approaches which could improve the efficiency and efficacy of the passenger transport network.

The presentation by Hudson Janisch, Professor of Law, University of Toronto, is a discussion on the importance of procedure, such as the General Rules of the Commission. The seminar emphasizes the need for, and the present lack of, an effective dialogue between administrators and lawyers on procedures appropriate for regulation.

Risk assessment within the context of transportation of dangerous commodities is the focus of the address by Ian Burton, Director, Institute for Environmental Studies, University of Toronto. The discussion addresses the need for an enhanced element of rationality in the decision-protection-allocation process in the face of limited available funds to reduce risks of all kinds.

It must be taken for granted that the opinions expressed in these papers are those of the respective authors and do not necessarily reflect the views of the Canadian Transport Commission.

Yves Dubé
Vice-President (Research)

CONTENTS

THE COST STRUCTURE OF THE CANADIAN AIRLINE INDUSTRY AND REGULATORY INTERVENTION: A MULTI-PRODUCT APPROACH

David W. Gillen and Tae H. Oum 1

WESTERN CANADIAN TRANSPORTATION PROBLEMS AND OPPORTUNITIES: A BULK SHIPPER'S PERSPECTIVE

K.B. Boyle and W.A. Tett 51

PASSENGER TRANSPORT INTERCONNECTIONS, RIGHTS-OF-WAY AND REGULATION

David McQueen 67

WHY IS PROCEDURE IMPORTANT? A LAWYER'S VIEW OF THE CTC GENERAL RULES

H.N. Janisch 87

RISK ASSESSMENT FOR THE TRANSPORT OF HAZARDOUS COMMODITIES

Ian Burton 107

THE COST STRUCTURE OF THE CANADIAN AIRLINE INDUSTRY AND REGULATORY INTERVENTION

A Multi-product Approach

by

David W. Gillen
School of Business
and Economics
Wilfrid Laurier University
Waterloo, Ontario

Tae H. Oum
Faculty of Commerce and
Business Administration
University of British Columbia
Vancouver, B.C.

THE COST STRUCTURE OF THE CANADIAN AIRLINE INDUSTRY AND REGULATORY INTERVENTION

A Multi-product Approach*

I. INTRODUCTION

Deregulation of the U.S. airline industry took effect in 1977. However, since 1972, a massive amount of industry, government and academic research has attempted to show the costs and non-workability of regulation and the most likely ramifications of deregulation (see G. Reschenthal and B. Roberts (1979), Douglas and Miller (1974), Gillen and Oum (1983, ch. 3) for a summary of this literature). Within this context, there had been few studies focusing on the cost structure of the airline industry prior to 1974, while there were numerous examples of demand estimation. These few examples (Keeler, 1972; Douglas and Miller, 1974) used relatively simple statistical cost equations to measure the efficiency losses associated with quality competition resulting from the U.S. airline regulation.

The recent Regulation Reference of the Economic Council of Canada (1980) and work by W.A. Jordan (1979) have both argued for a loosening of the regulatory strings in Canada based on an analysis of the American experience. In fact, these recommendations are formulated on the assumption that the production technology for air service in the two countries is similar and exhibits constant returns to scale.

---

* This paper was presented to the Canadian Transport Commission on January 28, 1983.

Regulation of airlines in Canada differs from that of the U.S. in a number of ways, but most importantly, up until the late seventies, capacity shares were regulated.[1] There are entry, route and price regulations still in force in Canada. Therefore, in order to evaluate the efficiency implications of the current airline regulations in Canada, it is essential to examine how the cost of an airline operation varies with respect to the scale of its operation, nature of its network and markets, and the mixture of its output types. The purpose of this paper is to address these questions by estimating an airline cost function and examining its structures.

In Section II, a cost model is developed which not only characterizes the multi-product nature of the airline production but also reflects the effects of variations in the network and market characteristics across firms and over time, and thus is capable of appropriately capturing the effects of controlling major regulatory variables. In Section III, the cost function estimated is applied to the Canadian airline data to evaluate such measures as economies of scale and scope, and growth rates of total factor productivity over time. In Section IV, the effects of network and market characteristics on production costs are examined. The estimated cost model is also used to examine the consequences of redistributing routes across firms. A summary and conclusion complete the paper.

II. COSTING MODEL

All of the cost investigations concluded that airline production technology exhibits constant returns to scale until Caves, Christensen and

Treathway (1980) reported substantial scale economies for the U.S. trunk air carriers. Roy (1980) also concluded a non-homothetic cost function as being appropriate for the Canadian airline industry.

While wishing to investigate the scale issue, this analysis also seeks to realistically characterize the production technology; the multi-product nature of the airline production taking place over space with different networks and market densities. In this case, the duality approach which is well documented (see Fuss and Waverman, (1981); Gillen and Oum, (1982)) is used. Duality theory implies that if firms are input price takers, and they minimize costs of producing each output vector, then a cost function satisfying usual regularity conditions contains sufficient information to characterize the production technology. Therefore, one can specify and estimate the cost function in a rather general form such as in equation (1), and use it to examine the structure of production technology of an industry:

(1) $C = C\left[\phi_1(Y_1 - q_1), \phi_2(Y_2, q_2), \ldots, \phi_m(Y_m, q_m), W^*\right]$

where

Y_i = output of class i, $i = 1, 2, \ldots, m$;

$q_i = [q_{i1}, q_{i2}, \ldots, q_{ir_i}]\, 1 \times r_i$ vector of network and market variables describing the nature of the i^{th} output class,

$W_i^* = [W_1^*, W_2^*, \ldots, W_n^*]$;

$W_i^* = W_i \cdot exp(\alpha_i \cdot t)$ representing price of output i adjusted for technological changes over time,

W_i = observed price of input i;

t = time variable indicating the year,

$\phi_i(Y_i, q_i)$ = output of class i, adjusted for network and market variables, $i = 1, 2, \ldots, m$.

$\phi_i(Y_i, q_i)$ can be regarded as a hedonic measure of output, adjusting for variations in output dimensions dictated by the network and market characteristics.

For the purposes of estimation, the cost function (1) in the translog form is specified as follows[2]:

$$(2)\quad \ell n\, C(\phi, W, t) = a_0 + \sum_i^m a_i\, \ell n\phi_i + \sum_i^n b_i\, \ell n W_i^* + \frac{1}{2}\sum_i^m \sum_j^m a_{ij}\, \ell n\phi_i\, \ell n\phi_j$$

$$+ \frac{1}{2}\sum_i^n \sum_j^n b_{ij}\, \ell n W_i^*\, \ell n W_j^* + \sum_i^n \sum_j^m c_{ij}\, \ell n W_i^*\, \ell n\phi_j$$

where

$\phi_i = Y_i \cdot \prod_{\ell=1}^{N_i} q_{i\ell}^{\beta_{i\ell}}$ is the hedonic (dimension-adjusted) output function for class i;

Y_i = observed output of class i, $i = 1, \ldots, m$;

$W_i^* = W_i \cdot exp(\alpha_i \cdot t)$ adjusted price of input i, $i = 1, \ldots, n$;

W_i = price of input i;

t = time variable;

a_0, a_i's, a_{ij}'s, b_{ij}'s, c_{ij}'s, are the parameters of the translog function;

$\beta_{i\ell}$'s are the parameters of the hedonic output function for output class i;

α_i's are the parameters of factor price adjustment function representing non-neutral technical change over time.

The share expenditure of the i^{th} input S_i is obtained by applying Shephard's lemma to (2).

$$(3)\quad S_i = \frac{\partial \ell n\, C(.)}{\partial \ell n\, W_i^*} = b_i + \sum_j^n b_{ij}\, lnW_j^* + \sum_j^m c_{ij}\, ln\phi^j$$

$$i = L, K, F$$

while the symmetry conditions, linear homogeneity in input prices and summing up of expenditure shares impose the following restrictions:

$$(4)\quad a_{ij} = a_{ji}, b_{ij} = b_{ji} \text{ for all } i \neq j$$

$$\sum_j^n b_i = 1, \sum_j^n b_{ij} = 0, \sum_j^n c_{ij} = 0$$

The model is estimated on data for the two trunk and four regional air carriers for the period 1964-78.[3] The output and network variables are:

(1) Y_1: scheduled (unit toll) revenue passenger-miles,

q_{11}: passenger load-factor; percentage of revenue passenger-miles to available passenger-miles,

q_{12}: average stage length in miles; (revenue-miles flown)/(number of departures),

q_{13}: weighted average number of seats per aircraft; (available seat-miles/(aircraft miles flown),

(2) Y_2: scheduled (unit toll) revenue freight ton-miles,

q_{21}: total weight load-factor for scheduled freight; (revenue goods ton-miles)/(available ton-miles - passenger ton-miles),

q_{22}: average length of haul for revenue freight, in miles; (freight ton-miles)/freight tons),

q_{23}: weighted average available freight tons per aircraft; (ton-miles available for freight)/(number of miles flown),

(3) Y_3: non-scheduled (charter) revenue ton-miles including passenger and freight services,

q_{31}: average stage length of charter services in miles; (miles flown for charter)/(departures for charter),

q_{32}: revenue tons per departure; (passengers and freight (in tons))/(departures),

q_{33}: proportion of charter passenger ton-miles to total revenue ton-miles for all services; (charter passenger ton-miles)/(total ton-miles).

The input price indices were constructed using the Divisia aggregation procedure (see Gillen and Oum (1982), for a full explanation).

(1) W_1: price index of labour (Divisia aggregation of all labour categories),

(2) W_2: rental price of capital including flight and non-flight capitals (Divisia aggregation of all categories of capital, equipment and materials, etc.),

(3) W_3: fuel price (Divisia aggregation of all fuel categories).

The cost function and expenditure share functions for capital and fuel were estimated simultaneously on 90 observations (six firms for 1964-78) using a non-linear multivariate least squares procedure. The

restrictive structures such as homotheticity, input-output separability, log-linearity, ray constant returns to scale, and cost independence between outputs were also tested around the 1977 CP Air data point. The asymptotic likelihood ratio criterion was used for the tests. The results of the tests are contained in Table 1 and the parameter estimates for the general non-homothetic joint cost model are contained in Table 2.

The test results of Table 2 indicate that airline production technology is best characterized by a non-homothetic cost structure exhibiting a common technology. Thus, many of the previous studies on airline costs (for example, Caves (1962), Straszheim (1969) and Douglas and Miller (1974) which aggregated outputs and/or imposed restrictive functional forms are likely to have yielded biased results.

III. SCALE, SCOPE AND PRODUCTIVITY

Baumol (1977), Baumol, Bailey and Willig (1977), and Panzar and Willig (1977) have introduced the notion of a "subadditive" cost function as a method of characterizing the structure of joint production. A cost function is said to be subadditive at an output vector, say Y^*, if and only if it is cheaper to have a single firm produce Y^* than it is to split it among more than one firm in any fashion.[4] Therefore, clearly subadditivity is the basis upon which to determine the least cost productive organization. While the subadditivity per se is very difficult to test, its sufficiency conditions expressed in terms of various scale and scope economies are more amenable to statistical tests. Baumol (1977, proposition 12) has shown that a cost function is strictly subadditive at output vector Y^* if the ray

Table 1

TESTS ON ALTERNATIVE STRUCTURES OR PRODUCTION TECHNOLOGY

Hypothesis	Form of Cost Function	Restrictions on Translog Parameters	Degrees of Freedom	X^{2-} statistic $(-2\ell n\lambda)$	Test Results $\alpha = .01$
General non-homothetic structures	$C = C(\phi, W)$	standard: symmetry, linear homogeneity and adding-up of shares	-	-	-
Input-Output separable structure	$C = C[0(\phi), W]$	$c_{ij} = p_i \cdot a_j \quad i = 1, n$ $j = 1, m$	3	78.81	reject H_o
Homothetic* structure	$C = o(\phi) \cdot I(W)$	$c_{ij} = 0 \quad i = 1, n$ $j = 1, m$	6	107.75	reject H_o
Log-linear* structure	$C = A \prod^{m} \phi^{i} \cdot^{a_i}{}_{k} \prod^{n} W_k^{b_k}$	$a_{ij} = b_{ij} = c_{ij} = 0$	15	111.37	reject H_o
Non-joint** technology	lack of economies or diseconomies of scope	$a_{ij} = -a_i \cdot a_j \quad i \neq j$ $i, j = 1, m$	3	84.06	reject H_o
Overall ray constant** returns to scale		$\sum a_i = 1$	1	9.02	reject H_o

* The translog function is used as an exact function when these hypotheses are tested.

** These restrictions are valid only at the point of approximation, i.e., $\phi^{i} = W_j = 1$ for all i.

Table 2

PARAMETER ESTIMATES OF COST AND SHARE EQUATIONS
(asymptotic t-statistics in parentheses)

Parameter	Variable	Estimate	Parameter	Variable	Estimate
a_0	constant	0.27620 (11.28)	* c_{1K}	Y_1W_K	0.0270 (3.48)
a_1(passenger)	Y_1	0.83650 (67.38)	c_{2L}	Y_2Y_L	0.0230 (3.24)
a_2(freight)	Y_2	0.11770 (25.42)	c_{2F}	Y_2W_F	-0.0229 (7.75)
a_3(non-scheduled)	Y_3	0.10360 (9.18)	* c_{2K}	Y_2W_K	-0.0002 (0.02)
b_L	W_L	0.32980 (38.31)	c_{3L}	Y_3W_L	-0.0071 (0.98)
b_F	W_F	0.19280 (49.00)	c_{3F}	Y_3W_F	0.0201 (5.31)
* b_k	W_K	0.47080 (48.05)	* c_{3K}	Y_3W_K	-0.0131 (1.98)
a_{11}	Y_1^2	0.16940 (18.15)	β_{12} (average stage length)	q_{12}	-0.2928 (12.61)
a_{12}	Y_1Y_2	-0.05078 (12.12)	β_{13} (seats per aircraft)	q_{13}	0.1128 (2.84)
a_{13}	Y_1Y_3	-0.13770 (14.07)	β_{23} (available freight tons per aircraft)	q_{23}	-0.3165 (4.77)
a_{22}	Y^2	0.05840 (16.92)			
a_{23}	Y_2Y_3	-0.02040 (5.22)	β_{31} (average stage length of charter services)	q_{31}	-0.4682 (8.16)
a_{33}	Y_3^2	0.16930 (12.56)			
α_L(labour)	W_L	-0.05160 (4.14)	β_{33} (proportion of charter passenger ton-miles)	q_{33}	-0.6616 (16.85)
α_F(fuel)	W_F	-0.01030 (1.60)			
α_K(capital)	W_K	-0.04640 (6.97)			
b_{LL}	W_L	-0.05050 (1.61)			
b_{LF}	W_LW_F	-0.08190 (0.84)	Equation	R^2	
* b_{LK}	W_LW_K	0.05870 (2.00)	Cost	0.99	
b_{FF}	W_F^2	0.11130 (14.48)	Labour	0.67	
* b_{FK}	W_FW_K	-0.10310 (8.26)	Fuel	0.88	
* b_{KK}	W_K^2	0.04430 (1.39)	Capital	0.67	
c_{1L}	Y_1W_L	-0.02320 (2.91)			
c_{1F}	Y_1W_F	-0.00380 (1.01)			

* These parameters were computed from the restrictions imposed on the model.

average costs are strictly declining and (non-strict) transray convexity holds at the output vector.

The ray cost elasticity, E_{cy}, characterizes shapes of the ray average cost curves, and its inverse is in fact the ray economies of scale measure S:

$$(5a)\quad E_{cy} = \sum \frac{\partial \ell nc}{\partial \ell n\phi_i} = \sum_i (a_i + \sum_j a_{ij}\, \ell n\phi_j + \sum_k C_{ik}\, \ell nW^*)$$

$$(5b)\quad S = 1/E_{cy}$$

"S" indicates economies (>1), constant returns ($=1$) and diseconomies (<1) of scale. Transray convexity is concerned with the properties of the cost function when the product mix changes. Baumol (1977) has noted that transray convexity is closely related (but not necessarily equivalent) to economies of scope. For the case of two products, Willig (1979) shows that the multi-product economies of scale are inextricably related to economies of scope and product-specific economies of scale. Mintz (1981) generalized Willig's result to N products. For the case of three outputs, the relationships can be written as:

$$(6a)\quad S = \frac{\sum_j \alpha_j S_j}{1 - \sum_j SC_j + S_c}$$

where

$$\alpha_j = \frac{\frac{\partial C}{\partial \phi_j} \cdot \phi_j}{\sum_j \frac{\partial C}{\partial \phi_j} \cdot \phi_j} = \text{proportion of the total marginal cost of product } j \text{ to the total marginal costs of all products.}$$

(6b) $S_j = \dfrac{IC_j}{\phi_j \cdot \dfrac{\partial C}{\partial \phi_j}}$ = product-specific economies of scale;

$IC_2 = C(\phi_1, \phi_2, \phi_3) - C(\phi_1, 0, \phi_3)$ = incremental cost of producing product 2;

(6c) $SC_2 = \left[C(\phi_1, 0, \phi_1) + C(0, \phi_2, 0) - C(\phi_1, \phi_2, \phi_3)\right] / C(\phi_1, \phi_2, \phi_3)$ = product-specific (or incremental) economies of scope for product 2;

(6d) $S_c = \left[\sum_j C(\phi_j) - C(\phi_1, \phi_2, \phi_3)\right] / C(\phi_1, \phi_2, \phi_3)$ = overall (or "weak" in Mintz's terminology) economies of scope;

$C(\phi_j)$ is the cost of producing product j separately, i.e., stand-alone cost.

This implies that in order to understand the causes of multi-product economies of scale at a local point, one needs to examine the product-specific economies of scale and scope and overall economies of scope.[5] For instance, a positive value of the net economies of scope (i.e., the sum of product-specific economies of scope less the weak economies of scope, $\sum_j SC_j - S_c$) contributes to the overall ray economies of scale. Computation of these measures requires extrapolation of the estimated cost function well beyond the range of the observed data, particularly by setting one or more outputs to zero. Although technically these can be evaluated using a "generalized" translog cost function (see Fuss and Waverman (1981, p. 104); Caves, Christensen and Tretheway (1980), and reference 3), the extent to which the results can be trusted would be questionable at best. Therefore, a less formal but more reliable procedure has been used.

Panzar and Willig (1978, proposition 2) have shown that a twice differentiable multi-product cost function which exhibits cost complementarities between all pairs of outputs with no sunk cost (i.e., $C(0,0,0) = 0$), exhibits economies of scope.[6] The condition for cost complementarity between products i and j can be examined by evaluating the following cross-partial derivatives at each data point of present interest

$$(7)\quad \frac{\partial^2 C}{\partial \phi_i \partial \phi_j} = \frac{C}{\phi_i \phi_j}\left[\left(a_i + \sum_{\ell}^{m} a_{i\ell} \ell n \phi_\ell + \sum_k c_{ki} \ell n W_k^*\right)\right.$$

$$\left.\cdot\left(a_j + \sum_{\ell}^{m} a_{j\ell} \ell n \phi_\ell + \sum_k c_{kj} \ell n W_k^*\right) + a_{ij}\right] < 0.$$

Since the expressions for ray economies of scale in equation (5) and for cross-partial derivatives of the cost function in equation (7) depend upon the data for the formal tests, the data are scaled such that the point of approximation becomes $\phi_i = W_j = 1$ for all $i = 1,m$ and $j = 1,n$. One can now impose the following restrictions on the parameters in order to test for the ray constant returns to scale and for the cost independence between outputs i and j at the approximation point:

(8a) $E_{cy} = a_1 + a_2 + a_3 = 1$: ray constant returns to scale.

(8b) $\dfrac{\partial^2 C}{\partial \phi_i \partial \phi_j} = a_1 . a_j + a_{ij} = 0$: cost independence for all $i \neq j$.

As indicated in Table 2, the tests using 1977 CP Air data as the approximation point rejected both ray constant returns to scale and overall cost independence among the three outputs.

Therefore, the unconstrained model was estimated without imposing conditions for the constant returns to scale and the cost independence in order to examine the directions and magnitudes of scale and scope economies at the approximation point, i.e., the 1977 CP Air data. The relevant values of parameter estimates (asymptotic t-ratio in parentheses) are as follows:

ray cost elasticity:

$$a_1 + a_2 + a_3 = 1.0578$$

(t-ratio for $a_1 + a_2 + a_3 - 1 : 5.22$)

cross-partial derivatives:

$a_1 \cdot a_2 + a_{12} = +.0234$ (4.83): scheduled passenger and freight services,

$a_1 \cdot a_3 + a_{13} = -.0631$ (5.13): scheduled passenger service and charter service,

$a_2 \cdot a_3 + a_{23} = -.0098$ (1.35): scheduled freight service and charter service.

The ray cost elasticity exhibits a presence of statistically significant ray diseconomies of scale at the 1977 CP Air data point. The evidence on cross-partial derivatives indicates strong productive complementarity between scheduled passenger and charter services, weak complementarity between scheduled passenger and charter services and a clear lack of productive complementarity between scheduled passenger and scheduled freight services.

Since results of the formal tests are valid only at the point of approximation, whereas the main interest is in the entire cost structure, the cross-partial derivatives of the cost function were also evaluated using equation (7) at each data point, and the selected results are reported in Table 3. To facilitate the interpretation, the relative magnitudes of the three outputs produced by each carrier are also listed in Table 4.

Scheduled passenger and charter services have been productively complementary for Air Canada, CP Air, Eastern Provincial Airways (EPA), Transair and Nordair over the time periods examined and in the earliest part of the period for Quebecair, implying a cost advantage of joint production of the two services. The extent of this cost complementarity has been much higher at the level of operation of the regional carriers than for the trunk airlines. The cost complementarity has decreased steadily over the 15-year period between 1964-78. Exceptions to this are Pacific Western Airlines (PWA) for the entire period and Quebecair for the last few years. These airlines appear to have produced an inefficient mix of the two services. This is most likely to have resulted from the disproportionately high level of charter services relative to scheduled passenger services. The charter service's share of total revenue ton-miles (RTM) has always been approximately 50% for PWA and was 75.4% for Quebecair in 1978.

Table 3

SIGNS OF CROSS-PARTIAL DERIVATIVES EVALUATED AT SELECTED DATA POINTS

	$\frac{\partial^2 C}{\partial y_1 \partial y_2}$	$\frac{\partial^2 C}{\partial y_1 \partial y_3}$	$\frac{\partial^2 C}{\partial y_2 \partial y_3}$
Air Canada			
1964	+	−	−
1971	+	−	−
1978	+	−	−
CP Air			
1964	+	−	−
1971	+	−	−
1978	+	−	−
PWA			
1964	+	+	+
1971	+	+	+
1978	+	+	+
Quebecair			
1964	+	−	−
1971	+	−	−
1978	−	+	+
EPA			
1964	−	−	+
1971	+	−	−
1978	+	−	−
Transair			
1964	−	−	+
1971	+	−	−
1978	−	−	+
Nordair			
1971	−	−	+
1978	−	−	+

Table 4

SHARES OF REVENUE-TON-MILES AND TOTAL REVENUE AMONG THE THREE OUTPUTS

Airline	Year	Shares of RTM			Total RTM (in million ton-miles)	Shares of Revenue			Total Revenue (in millions of dollars)
		Scheduled Passengers	Scheduled Freight	Charter		Scheduled Passenger	Scheduled Freight	Charter	
Air Canada	1964	0.7739	0.1661	0.0600	377.79	0.8331	0.1302	0.0366	212.55
	1971	0.6715	0.2554	0.0730	957.01	0.8181	0.1430	0.0389	501.67
	1978	0.7470	0.2116	0.0413	1608.76	0.8587	0.1171	0.0240	1286.92
CP Air	1964	0.7625	0.1348	0.1026	113.94	0.8098	0.1237	0.0665	60.54
	1971	0.7463	0.1883	0.0654	322.92	0.8292	0.1334	0.0374	154.93
	1978	0.7205	0.1862	0.0933	657.96	0.8204	0.1201	0.0595	337.88
PWA	1964	0.3645	0.2041	0.4314	12.24	0.4534	0.1936	0.3530	8.84
	1971	0.3396	0.0845	0.5759	74.31	0.5642	0.1029	0.3329	45.25
	1978	0.3911	0.0895	0.5193	142.78	0.6422	0.0902	0.2675	137.71
Quebecair	1964	0.8603	0.1298	0.0100	3.90	0.8293	0.1607	0.0099	3.62
	1971	0.6191	0.0994	0.2814	14.18	0.7249	0.1451	0.1300	11.72
	1978	0.2318	0.0322	0.7540	87.44	0.4046	0.0513	0.5441	73.32
EPA	1964	0.4896	0.3810	0.1294	5.24	0.4088	0.2691	0.3221	5.35
	1971	0.7980	0.1720	0.0300	17.96	0.8085	0.1417	0.0497	14.79
	1978	0.6890	0.1113	0.1996	42.92	0.7892	0.1221	0.0886	49.93
Transair	1964	0.2391	0.0589	0.7020	8.38	0.3583	0.1285	0.5131	4.96
	1971	0.6574	0.0822	0.2603	18.19	0.7487	0.0928	0.1585	13.68
	1978	0.4869	0.0562	0.4568	47.07	0.6824	0.0874	0.2302	41.95
Nordair	1971	0.1755	0.3567	0.4678	33.95	0.3108	0.2469	0.4423	16.41
	1978	0.1912	0.1540	0.6547	84.90	0.3747	0.1813	0.4439	60.22

The three largest airlines (Air Canada, CP Air and PWA) have suffered cost inefficiences from the joint production of scheduled passenger and freight services; this is true at least locally for the entire 15-year period. This may be attributed (for the two trunk carriers) to the generally high proportion of total RTM to scheduled freight services. PWA too, has produced a disproportionately large amount of freight service relative to scheduled passenger service. The results on Quebecair, EPA and Transair are mixed depending on the year in which a particular combination of the outputs was produced. Nordair has exhibited productive complementarity during the entire period of 1971-78.

In general, it is observed that airlines with a high proportion of freight traffic relative to their passenger service exhibit a lack of cost complementarity (or exhibit cost inefficiency) between the two services probably because of the over-expansion of freight services beyond the efficient mix.

From the tables, one may observe a general relationship that the year in which an airline devoted more than 40% of its total RTM to charter services or more than 30% to scheduled freight services, it exhibited a positive cross-partial derivative, $\partial^2 C/\partial y_2 \partial y_3$, implying an inefficient mix of the two services. In particular, PWA and Nordair which have concentrated on charter services, exhibit an inefficient mix of the two services for the entire period.

As indicated above, the formal test at the 1977 CP Air data point rejected ray constant returns to scale. The ray cost elasticity (5a) and the ray economies of scale (5b) were also evaluated at each data point. These are reported in Table 5 along with output-specific cost elasticities $\frac{\partial \ell nC}{\partial \ell n\phi_i}$. The evident variability in the scale measured over time and across airlines, reflects changes in aircraft technology, output mixture and network and market differences.

The two trunk carriers (CP Air and Air Canada) and PWA have clearly achieved ray decreasing returns to scale of varying degrees, depending on the particular mix of outputs and the state of production technology in each year, as indicated in Figures 1 and 2.

It is interesting to observe that PWA, while being a much smaller airline relative to the trunks, exhibits roughly the same degree of ray decreasing returns to scale as CP Air in 1978. It is highly likely that an inefficient mix of the three outputs (heavily charter-oriented throughout the period), as discussed in the previous section on economies of scope, is the reason for the decreasing returns to scale. All other regional carriers exhibit ray increasing returns to scale during the entire study period.

Air Canada's cost elasticities for the scheduled passenger and the charter services were 97% and 8.1% in 1978 versus shares of RTM of 74.7% and 4.1%, respectively. This, in conjunction with the observed complementarity between these two services and the ray decreasing returns to scale, indicates that the productive efficiency could be improved by reducing the scheduled services and/or increasing charter services. CP Air's cost

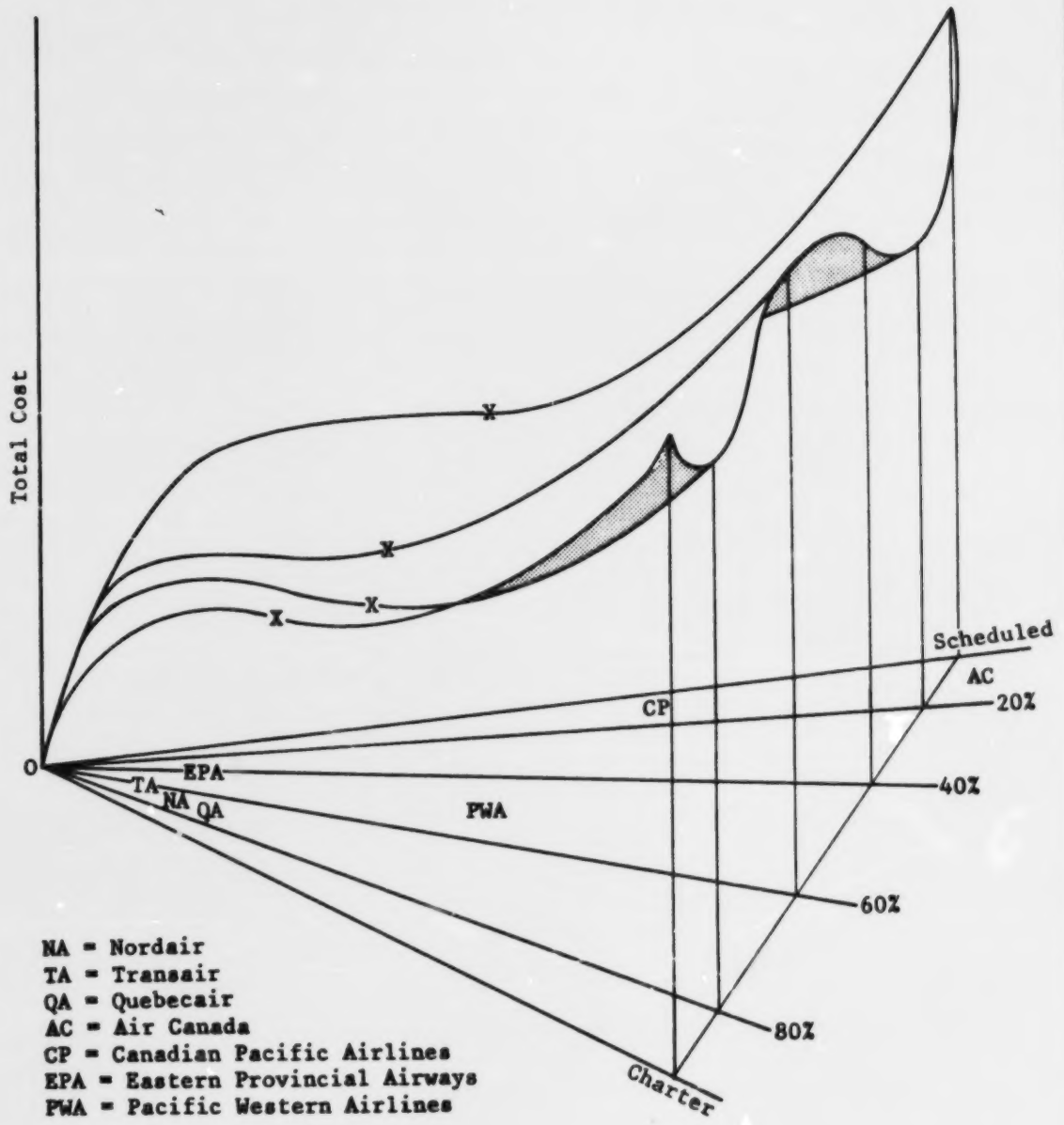
Table 5

SCALE ECONOMY MEASURES

Airline	Year	Ray Scale Economies	Ray Cost Elasticity	Product Specific Cost Elasticity Y_1	Y_2	Y_3
Air Canada	1964	0.969	1.032	0.850	0.133	0.049
	1971	0.934	1.071	0.831	0.145	0.095
	1978	0.845	1.183	0.970	0.132	0.081
CP Air	1964	0.850	1.176	0.968	0.148	0.061
	1971	0.927	1.079	0.892	0.143	0.043
	1978	0.881	1.135	0.906	0.133	0.096
PWA	1964	0.925	1.080	0.477	0.204	0.399
	1971	0.890	1.123	0.665	0.123	0.335
	1978	0.889	1.124	0.702	0.099	0.323
Quebecair	1964	1.140	0.877	0.677	0.170	0.088
	1971	1.280	0.781	0.549	0.099	0.134
	1978	1.148	0.871	0.416	0.055	0.400
EPA	1964	1.683	0.594	0.307	0.132	0.154
	1971	1.168	0.856	0.653	0.129	0.074
	1978	1.145	0.873	0.672	0.091	0.110
Transair	1964	1.518	0.659	0.303	0.095	0.261
	1971	1.099	0.910	0.629	0.086	0.194
	1978	1.247	0.802	0.523	0.066	0.213
Nordair	1971	1.780	0.562	0.165	0.141	0.255
	1978	1.774	0.563	0.216	0.093	0.254

Figure 1

COST SURFACE AS THE PROPORTION AND
LEVEL OF SCHEDULED PASSENGER
AND CHARTER SERVICES CHANGES

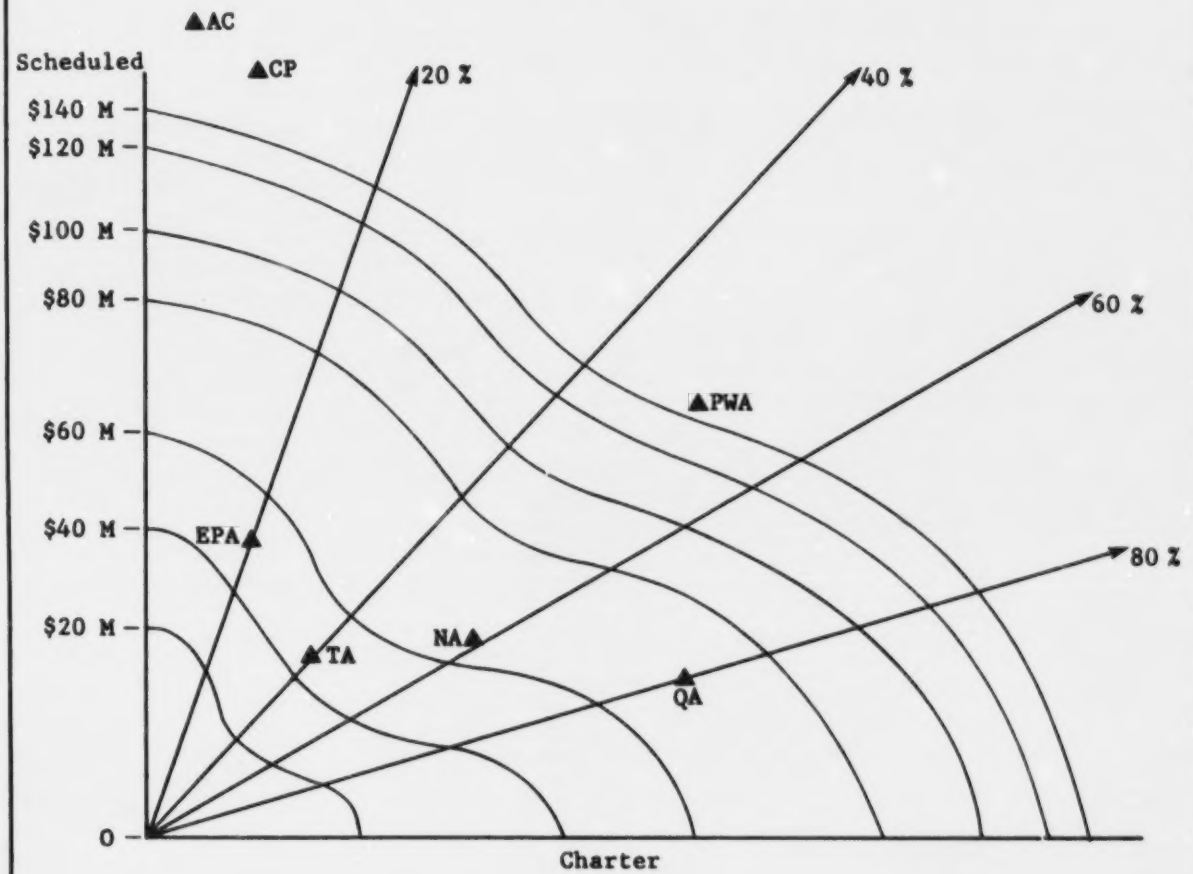


NA = Nordair
TA = Transair
QA = Quebecair
AC = Air Canada
CP = Canadian Pacific Airlines
EPA = Eastern Provincial Airways
PWA = Pacific Western Airlines

X: Constant Returns to Scale

Figure 2

ISOCOST CURVES



elasticity for the scheduled passenger service was 90.6% in 1978 as compared to its RTM share of only 72%. This, in addition to the fact that there are ray decreasing returns to scale, indicates that the efficiency would be improved if the size of the scheduled passenger services was reduced. Since PWA's ray decreasing returns to scale appear to be the result of its relatively high concentration on charter services, it follows that a reduction of charter services and/or an increase in the scheduled services would likely improve the productive efficiency of the system. Based on the ray increasing returns to scale prevailing in the other four regional carriers and their concentration on the charter and/or the scheduled freight services, it is clear that the productive efficiency would be improved if the size of their scheduled passenger services were to be increased.

The evidence presented thus far indicates that (i) the air carrier's ray average cost curves are U-shaped, (ii) although the minimum ray average cost size depends on the output mix (smaller least-cost size for heavily freight or charter-oriented airlines), on an overall basis it is fairly small in size - somewhere between the size of PWA (143 million RTM in 1978) and that of Quebecair (87 million RTM in 1978). These results are illustrated, for the scheduled passenger and charter service combinations in Figures 1 and 2. It is evident that ray average costs are U-shaped and the level at which decreasing returns set in depends on the mix of outputs. For example, PWA exhibits decreasing returns at a much lower level of output than the two trunks because of its highly inefficient product mix.

Since there exists, at all of the data points included in this study, ray diseconomies of scale and/or local diseconomies of scope between

some pairs of the three outputs, the sufficiency condition for subadditivity of the production cost does not hold at the level and mixture of outputs that have been produced by either the trunk carriers or the regional carriers. This failure to satisfy the sufficient condition does not necessarily guarantee the existence of one or more lower cost allocations of the total industry output among the airlines, different from the current allocation. However, if the marginal costs adjusted for differences in network and market conditions are different between any two airlines whose networks are either overlapping or adjacent, then the total cost of producing the combined output of the two airlines would be lower under a partial reallocation of the outputs away from the carrier, with a higher marginal cost to the other carrier. This is a clear indication that subadditivity of the cost function is violated at least locally at the current output levels of the former airline.

In view of the substantial ray decreasing returns to scale and the local diseconomies of scope between the two scheduled services observed at the output levels of the two trunk carriers, the marginal cost of the scheduled passenger services, adjusted for the differences in network and market conditions, are likely to be higher than those of the regional carriers. This result shall be presented later. Therefore, it is fair to say that the subadditivity of the cost function is violated at the output level of the two trunk carriers primarily because of the over-expansion of scheduled passenger services beyond an efficient level. Thus, the total cost of production would be reduced if some scheduled passenger services, currently under the two trunk carriers, were reallocated to other carriers.

PWA exhibits substantial ray decreasing returns to scale, a major portion of which may have resulted from the inefficient mix of the three outputs as indicated by the local diseconomies of scope between all pairs of outputs. Although it is not clear to what extent a movement toward a more efficient mixture of the three outputs (increase in the scheduled services and reduction of the charter services) would reduce PWA's current ray decreasing returns to scale, the efficiency would be improved by increasing its scheduled passenger services and even more so by reducing its charter services.

Given the substantial ray increasing returns to scale and some local diseconomies of scope caused primarily by over-expansion of the freight and/or charter services, the efficiency of each of the other four regional carriers is likely to be improved by an expansion in their scheduled passenger services and/or redistribution of some of the freight and charter services to the local carriers.

Table 2 reported α_i as the annual rate of change in productivity of input i.[7] The parameter estimates $\alpha_L = -0.0516$, $\alpha_F = -0.0103$ and $\alpha_K = -0.0464$ indicate technological change has resulted in increasing productivity of labour, capital and fuel (in that order). The total factor productivity measure was also calculated in order to examine the productivity implications of airline policy, regulations and public ownership.

Total factor productivity stems from two sources: a scale (or output) effect if there are non-constant returns to scale as in this case since factor productivity can change as the scale of the operation changes;

and secondly, technical change, for example, the introduction of new generation aircraft or an innovative mix and utilization of the inputs, can change the production function. There may also be secondary and higher-order effects since technical change in a shifting production function also shifts the derived demand functions of factor inputs which, in turn, may contribute to the imbedded growth in factor productivity itself (Nadiri and Schankerman (1979)).

The parametric method applied to this cost model has a distinctive advantage over other methods because this cost model takes into account the differential impacts of network and market characteristics on the feasibility of productivity improvement. Total factor productivities of each firm attributable purely to technical progress (a measure of the rate of change over time), were computed utilizing the estimated cost function. When scale economies are present, the traditional non-parametric method of computing total factor productivity would be biased because of the effect on cost of changes in the scale of output over time. What one is interested in measuring is essentially the rate of shift in the production (or cost) function aside from the scale effect. The primal rate of change in factor productivity (ε_{ft}) is computed directly from the dual cost function (see Berndt and Khaled, (1979)) as follows:

$$(9)\quad \varepsilon_{ft} = \frac{-\sum_i \alpha_i S_i}{\sum_i (a_i + \sum a_{ij} \ell n \phi^j + \sum_k C_{ki} \ell n W_k^*)} = -\varepsilon_{ct} \cdot \varepsilon_{cy}^{-1}$$

where

S_i: expenditure share of input i,

$\varepsilon_{ct} = \frac{\partial \ell n C(.)}{\partial t}$: the percentage rate of change in cost due to both technical change and returns to scale; and

ε_{cy}: the ray cost elasticity.

ε_{β} provides a measure of the change in total factor productivity due purely to technological change, excluding any scale effect. A comparison of ε_{β} across firms operating in different competitive environments or under different ownerships allows one to evaluate their relative efficiencies. The results are contained in the first column of Table 6. The rate of change in total costs (ε_{ct}) is deflated by the ray cost elasticity ε_{cy} to obtain the net changes in total factor productivity attributable purely to the technical change, ε_{β}.

The figures show that during this period, the industry has experienced a rapid increase of about 3~7% annually in total factor productivity with a consequent downward shift in the cost function. The cause of the productivity improvement cannot be traced precisely to each input because the technical progress of the embodied and the disembodied types are observationally indistinguishable in the context of this cost function. However, it is highly likely that a major portion of the improvement in total factor productivity is attributable to the improvement in aircraft technology, particularly the shift from piston and turboprop to jet aircraft during the earlier parts of the period 1964-78.

The comparison of the rate of growth in total factor productivity across airlines clearly illustrates that Air Canada, CP Air and PWA realized

Table 6

COMPOSITION OF THE ANNUAL RATE OF CHANGE IN TOTAL FACTOR PRODUCTIVITY

Firm		ε_{ft}	ε_{ft}^{L}	ε_{ft}^{F}	ε_{ft}^{K}
Air Canada	1964	0.0429	0.0172	0.0011	0.0246
	1971	0.0415	0.0165	0.0010	0.0297
	1978	0.0338	0.0142	0.0019	0.0176
CP Air	1964	0.0372	0.0155	0.0011	0.0207
	1971	0.0410	0.0167	0.0010	0.0232
	1978	0.0359	0.0150	0.0018	0.0191
PWA	1964	0.0391	0.0182	0.0016	0.0193
	1971	0.0353	0.0150	0.0014	0.0190
	1978	0.0352	0.0148	0.0022	0.0182
Quebecair	1964	0.0495	0.0231	0.0016	0.0247
	1971	0.0545	0.0234	0.0021	0.0290
	1978	0.0441	0.0194	0.0031	0.0216
EPA	1964	0.0723	0.0349	0.0026	0.0347
	1971	0.0506	0.0218	0.0016	0.0271
	1978	0.0466	0.0196	0.0024	0.0245
Transair	1964	0.0629	0.0287	0.0029	0.0312
	1971	0.0462	0.0193	0.0019	0.0249
	1978	0.0495	0.0207	0.0030	0.0257
Nordair	1971	0.0773	0.0375	0.0026	0.0375
	1978	0.0711	0.0332	0.0041	0.0337

$\varepsilon_{ft}^{i} = \alpha_i S_i / \varepsilon_{cy}$ is the percentage change in total factor productivity per year purely due to technical changes which appeared in the form of productivity gain for input i. i = L, F, K.

$\varepsilon_{ft} = \varepsilon_{ft}^{L} + \varepsilon_{ft}^{F} + \varepsilon_{ft}^{K}$

ε_{cy} is the percentage change in total cost due to changes in output, i.e., ray cost elasticity.

substantially lower growth rates than the other airlines. The most dramatic gains occurred in the 1964-71 period and tailed off in 1972-78. There also seems to be no evidence that the Crown carriers achieved a lower or higher growth rate than the privately-owned carriers.

IV. COST AND NETWORK CHANGES

The hedonic output adjustment functions imbedded in (2) were designed to both homogenize outputs in order to examine the true cost-output relationship, and to see the effect of changes in network and market characteristics on costs.[8] The parameter estimates of the hedonic output functions are (asymptotic t-ratios and are in parentheses):

(a) scheduled passenger service:

$$\log \phi_1 = \log Y_1 - \underset{(12.61)}{.2928} \log q_{12} + \underset{(2.84)}{.1128} \log q_{13}$$

where

ϕ_1: scheduled revenue passenger-miles adjusted for the differences in network and market variables across airline companies over time;

Y_1: unadjusted scheduled revenue passenger-miles;

q_{12}: average stage length (in miles);

q_{13}: weighted average seats per aircraft;

(b) scheduled freight service:

$$\log \phi_2 = \log Y_2 - \underset{(4.77)}{3.165} \log q_{23}$$

where

ϕ_2: scheduled revenue freight ton-miles adjusted for the differences in market variables;

Y_3: unadjusted revenue ton-miles of passenger and freight charter services;

q_{31}: average stage length of charter services (in miles);

q_{33}: proportion of charter service ton-miles to total revenue ton-miles.

The above parameter estimates of the hedonic adjustment functions provide a direct measure of the effect of changes in network and market characteristics or 'effective' output and ultimately on the costs of production.

The parameter estimates of the hedonic adjustment function for scheduled passenger service (Y_1) indicate that the observed passenger-miles of an airline whose network and market characteristics are suitable to run flights with longer stage lengths ought to be adjusted downward for any meaningful cost study, particularly one involving cross-sectional airline data. At first glance, the positive sign for q_{13} (average seats per aircraft) appears somewhat counter-intuitive. This is partly due to the high correlation this variable has with other network and market adjustment variables in the model (with average stage length for scheduled passenger services q_{12}(.82), average freight tons per aircraft q_{23}(.85), and average stage lengths of charter services q_{31}(.86)). The positive sign for q_{13} may also be due partly to the fact that revenue outputs (rather than available outputs) are used in this cost model. Therefore, the cost increases as a result of the induced effect of aircraft size on the passenger load factor, other things being equal.

The hedonic adjustment function for scheduled freight services (Y_2) depends only on the average available freight tons per aircraft (q_{23}). The negative coefficient for q_{23} indicates economies of plane size in freight service. Although the average length of haul for revenue freight (q_{22}) may influence the cost per revenue ton-mile, this variable was excluded due to a very strong correlation (.96) with q_{12} (average stage length of scheduled passenger services).

The estimated hedonic adjustment function for charter services reveals that a substantial cost advantage exists in long-haul charter services (q_{31}) and/or in the production of charter services by a firm with a higher concentration on charter business (q_{33}). q_{32} (average revenue tons per departure) was not statistically significant at any reasonable level, most likely due to its high correlation with other variables, particularly q_{13} (.82) and q_{31} (.82).

To a large extent, the variables included in the hedonic function are regulatory control variables. It would seem to be of some interest to measure what effect changes in these variables - i.e., the decisions of regulators - have on costs. The effect of changes in total and marginal cost may be measured as

$$(10)\quad \frac{\partial MC(Y_i)}{\partial q_i \ell} = \frac{C \cdot B_{i\ell}}{Y_i \cdot q_{i\ell}} \left[(a_i + \sum a_{ij} \ell n \phi^j + \sum_k c_{ki} \ell n W_k^*)^2 + a_{ii} \right]$$

Table 7 reports changes in marginal costs of producing 1 000 units (passenger or ton-miles) of each output due to a unit change in a

Table 7

EFFECTS OF CHANGES IN OUTPUT CHARACTERISTICS ON MARGINAL COSTS

Firm		MCQ12	MCQ13	MCQ23	MCQ31	MCQ33
Air Canada	1964	-0.050	0.077	-10.61	-0.463	-177.060
	1971	-0.038	0.059	-3.53	-0.382	-114.200
	1978	-0.048	0.069	-4.68	-0.862	-486.200
CPAir	1964	-0.029	0.060	-9.02	-0.149	-48.600
	1971	-0.018	0.048	-5.33	-0.196	-118.800
	1978	-0.028	0.047	-5.52	-0.227	-83.900
PWA	1964	-0.138	0.187	-32.74	-2.022	-8.043
	1971	-0.122	0.127	-21.23	-0.180	-2.716
	1978	-0.230	0.159	-25.34	-0.341	-5.938
Quebecair	1964	-0.140	0.222	-1 080.00	-47.470	-11 479.700
	1971	-0.114	0.138	-57.58	-0.350	-11.990
	1978	-0.190	0.186	-112.76	-0.285	-2.430
EPA	1964	-0.135	0.280	-49.07	-7.240	-92.830
	1971	-0.089	0.151	-27.41	-7.310	-1 054.500
	1978	-0.140	0.106	-37.80	-0.398	-32.100
Transair	1964	-0.125	0.209	-133.50	-0.282	-1.890
	1971	-0.066	0.081	-23.34	-0.537	-12.630
	1978	-0.063	0.113	-51.16	-0.170	-5.620
Nordair	1971	-0.048	0.283	-10.75	-0.444	-4.890
	1978	-0.076	0.340	-10.67	-0.188	-3.000

Remarks: $MCQ_{il} = \frac{\partial MC(Y_i)}{\partial q_{il}} \times 1000$; change in the marginal cost of 1 000 units of nominal output Y_i with respect to one unit change in its lth characteristic. (in dollars)

MCQ33 are the effect of changes in respective marginal costs due to a 1% increase in Q33.

characteristic. However, only output Y_1 is discussed due to space limitations. As average stage length increases (q_{12}), the marginal cost per passenger-mile would fall in all cases. The effect, however, is greater for the regional air carriers relative to the nationals since the former have shorter stage lengths. The smallest reduction in marginal cost would be realized by increasing the average stage length of CP Air's scheduled passenger services because it already has the longest average stage length (880 miles in 1978). A larger reduction in the marginal cost would be realized by increasing the average stage lengths of Quebecair, PWA and EPA than the other carriers because in 1978 these carriers' average stage lengths were substantially shorter than the other four carriers. The results show a typical diminishing pattern in the economies of longer stage length.

As average seat capacity per aircraft departure (q_{13}) is increased by one, the marginal cost per thousand passenger-miles would have risen in 1978 by 6.9¢, 4.7¢, 15.9¢, 18.6¢, 10.6¢, 11.3¢ and 34¢, respectively for Air Canada, CP Air, PWA, Quebecair, EPA and Transair. This is compared to the 1978 realized levels of average number of seats per aircraft departure of 170.5, 202.8, 105.9, 62.2, 102.1, 75.6, and 31.2 seats for the respective airlines. At first glance, it seemed surprising to see that no economies of seat capacity per aircraft are observed in the scheduled passenger services. However, this is an empirically plausible result since average seat capacity is influenced heavily by the average stage length (the correlation between q_{12} and q_{13} coefficient 0.82), and a part of the effect of the average stage length on marginal cost is in fact due to the induced changes in average seat capacity per aircraft. Also, an increase in seat capacity per aircraft

without an equivalent reduction in schedule frequency would reduce the load factor and thus increase marginal cost per passenger-mile.

Therefore, in this model the effect of changes in q_{12} and q_{13} need to be evaluated jointly. For example, if CP Air's average stage length is increased by 10% of the 1978 level, making it 880 miles x 110% = 968 miles, and if the induced effect increases the seat capacity per aircraft by 10%, making it 203 seats x 110% = 223 seats, then the combined effect would be to reduce the marginal cost by $1.52 per thousand passenger-miles:

- 2.8¢. x 88 miles = - $2.46

+ 4.7¢. x 20 seats = + $0.94

combined effect = - $1.52

Since CP Air produced 4 740 million passenger-miles in 1978, the total saving would have been $4 740 000. In comparison to this, if one increases Quebecair's average stage length by 88 miles and also increases its average seat capacity by 20 seats, then the combined effect would be to reduce the marginal cost by $12.93 per thousand passenger-miles:

- 19.0¢. x 88 miles = - $16.72

+ 17.6¢. x 20 seats = + $ 3.79

combined effect = - $12.93

It is clear, therefore, that there is potential for reducing the total cost of the industry's production by transferring some of the trunk carriers' medium/long-haul routes to the regional carriers.

These estimates of scale and scope economies suggest that a redistribution of outputs from the trunks, particularly Air Canada, to the regional carriers would result in significant cost savings. This cost model can be used to evaluate the cost implications of alternative route licensing and market output policies. It is apparent from this analysis that the (average) cost function is U-shaped with PWA, CP Air and Air Canada exhibiting decreasing returns. Furthermore, it was found that the least cost firm size decreases as the proportion of charter services is initially increased. However, this trend appears to be reversed as a firm establishes a specialization and commits a substantial portion of its resources to charter services (e.g., Quebecair's proportion of the adjusted charter RTM was 52.6% in 1978). The least-cost firm size appears to be positively related to the extent of specialization in one output. The overall structure of ray average costs in adjusted output space implies that, in terms of the adjusted outputs, an output mix somewhere between CP Air and EPA is probably the most efficient one for a carrier with scheduled service orientation.

The result of air policy in Canada, including the Regional Air Carrier Policy developed in 1966, has been to effectively regulate the size of the regionals' scheduled services while relaxing their participation in charter services. This not only led the regionals to produce an inefficient mix of outputs (charter-oriented) and to stay inefficiently small, but it also induced the trunk carriers to produce an inefficient mix of outputs (too much of a scheduled service orientation) and to expand their already inefficiently large scale of operation. It seems clear that the efficiency of the airline industry as a whole would be improved if a significant

portion of the trunk carriers' scheduled services output were to be transferred to appropriate regional carriers. This change which is likely to be achieved under a liberalized entry situation would move both the trunk and the regional carriers to more efficient output rays and closer to the least-cost firm size.

In order to predict the effect of reallocating some of the scheduled services from the trunk carriers to the regional carriers, the estimated cost function was used to stimulate the average and total costs before and after the following reallocations:

> "Reduce the 1978 scheduled services outputs (both passengers and freight) by 30% from Air Canada and 15% from CP Air and reallocate it to the regional carriers in proportion to their existing outputs of the scheduled services in 1978."

Table 8 compares the ray average costs and the ray cost elasticities before and after the reallocation of the scheduled services.

Note first that the ray returns to scale measure for all airlines (ray cost elasticities) approaches the value of 1.0 after the reallocation implying a movement towards the least-cost firm size.

After the reallocation, ray average costs per adjusted RTM decreased substantially for all of the regional carriers, and decreased slightly for Air Canada while it was increased for the case of CP Air. Specifically, the ray average cost per adjusted RTM for Air Canada, PWA,

Table 8

COMPARISON OF THE 1978 PRODUCTION COSTS BEFORE AND AFTER THE REALLOCATION OF SCHEDULED SERVICES

Before Reallocation:

	% of charter RTM		Ray average cost per RTM		Ray cost elasticity
	adjusted	actual	adjusted	actual	
Air Canada	7.7%	4%	0.638	0.708	1.183
CP Air	9.1%	9%	0.605	0.616	1.135
PWA	30.0%	52%	0.884	0.882	1.124
Quebecair	52.6%	76%	0.823	0.638	0.871
EPA	12.8%	20%	0.803	1.067	0.873
Transair	26.0%	46%	0.935	0.832	0.802
Nordair	45.3%	65%	1.202	0.830	0.563

After Reallocation:

	% of charter RTM		Ray average cost per RTM (in $)		Ray cost elasticity
	adjusted	actual	adjusted	actual	
Air Canada	8.6%	5.8%	0.632	0.695	1.105
CP Air	9.6%	10.8%	0.655	0.658	1.002
PWA	16.7%	21.0%	0.678	0.919	1.027
Quebecair	28.5%	43.0%	0.711	0.846	0.974
EPA	7.6%	5.8%	0.686	1.012	0.948
Transair	14.2%	17.2%	0.724	0.848	0.906
Nordair	24.9%	32.2%	0.640	0.632	0.966

Quebecair, EPA, Transair, and Nordair decreased by about 0.9%, 23.3%, 13.6%, 14.6%, 22.6% and 46.7%, respectively while CP Air's ray average cost increased by about 8.3%. This calculation shows that this reallocation would have reduced the total cost of the 1978 outputs by about $40 million.[9]

V. SUMMARY AND CONCLUSIONS

This analysis has developed and tested a general joint cost model of the Canadian airline industry. Not only was the multiple output nature of the industry characterized in the cost equation but differences in aircraft capacity, route lengths and market densitities across airlines were considered. These characteristics were included in a hedonic adjustment function on each output. They served two purposes: first, to homogenize outputs so a true cost-output relationship could be investigated; and secondly, to examine the effect of changes in these characteristics on costs since some of them are under the control of regulators. The model was estimated on data for the four regional and two trunk carriers for the period 1964-78.

The airline industry was found to have a general non-homothetic joint cost structure which exhibits U-shaped ray average cost curves. This is one of only two studies which has not found constant returns to scale. It was also found in this investigation of scope economies that there is cost complementarity between scheduled passenger and freight services if the latter is less than 15% of the former. Also, scheduled services and charter services are mutually complementary when the carrier specializes in one of the two services using the other as a complement. This is most easily seen

in Figure 1 where the troughs of the total cost surface are aligned along the 80% and 20% rays. Certainly, the least cost firm size depends upon mix of outputs. It is evident, for example, that CP Air, Air Canada, and PWA all exhibited ray decreasing returns to scale: the two former mostly because of levels of output and the latter because of its failure to specialize (see Figure 2).

From the cost function, a parametric measure of the annual rate of growth in total factor productivity of 3~7% was calculated. The higher growth was in the 1964-71 period and the regionals dominated. There was, however, no significant evidence that Crown-owned air carriers are any more or less efficient than private sector airlines.

The effects of changes in variables in the hedonic adjustment functions on costs were also calculated. From these results, two important conclusions emerge. First, since route and market differences do affect the cost function, one cannot import the U.S. experience with respect to regulation or deregulation wholesale into Canada. Secondly, regulators in making route and entry decisions do affect the cost function. The concern has traditionally been with the revenue consequences of route and market entry awards but the cost consequences must also be examined.

Finally, the cost savings from reallocating outputs among airlines were investigated. It was found that air transport policy in Canada has elements of double jeopardy due to maintaining the pre-eminant position of Air Canada. Not only does this airline operate at an inefficient (high) level of output but this prevents the regional carriers from realizing the

available scale economies and forces them onto inappropriate output rays. By reallocating 30% of Air Canada's and 15% of CP Air's scheduled services to the other airlines, overall system costs were reduced by $40 million.

REFERENCES

1 The result is the lack of scheduling competition with the result on load factors and costs which played a central role in the deregulation arguments in the U.S.

2 The translog cost function is undefined at zero output levels of one or more products. However, knowledge of the production costs when one or more outputs are set to zero is essential to evaluate output-specific scale economies and all measures of scope economies as will become clear later in this paper. For this reason, the 'hybrid translog' form of the cost function (see Fuss and Waverman (1981, p. 104)) which is obtained from the translog function (2) by replacing the logarithmic output terms $\ell n\phi_l$, $i = 1,2,\ldots,m$, by the Boxcox metric: $(\phi_i^{\lambda} - 1)/\lambda$ was also estimated.

Note that $\lim_{\lambda \to o} \frac{\phi_i^{\lambda} - 1}{\lambda} = \ell n\phi_i$. (See Kmenta, p. 467 for this result.) However, the asymptotic X^{2-} statistic for testing hypothesis $\lambda = 0$ was only 1.18 as opposed to the critical value of 3.84 at a 5% level of significance.

Therefore, it was decided that the ordinary translog form (2) would be used. But, whenever it is required to evaluate the costs at some zero outputs, the hybrid translog functional form at $\lambda = 0.0001$ would be used since it is very close to the ordinary translog function (for example, Fuss and Waverman (1981) found very similar results using even $\lambda = 0.01$).

3 Nordair is not included in the estimation because of data problems prior to 1969. However, it is used in the predictions and simulations.

4 See Baumol (1977) and Baumol and Braunstein (1977) for the distinction between global and output-specific subadditivity of a cost function.

5 For example, for overall diseconomies of scale ($S < 1$) to be true, either at least one product-specific return to scale should be less than one or the net measure of scope economies should be negative, i.e., $(\sum_j SC_j - S_c) < 0$.

6 The existence of markets for the used airplanes, satisfies the condition of zero sunk cost. The estimated generalized translog cost function (see reference 3) was also evaluated at zero outputs and the value $C(0,0,0)$ was not found to be statistically different from zero at any reasonable level of significance. Although this is also subject to usual criticism due to extrapolation of the cost function to zero outputs, this also serves as evidence that cost complementaries imply the economies of scope.

7 Since embodied and disembodied technical change are observationally indistinguishable in this model, $-\alpha_i$ should therefore not be interpreted as the contribution due to the improved quality of input i.

8 For example, ten revenue passenger-miles of output can be generated by ten passengers travelling one mile or one passenger travelling ten

miles. Cost changes as output changes in the first case are a measure of density economies, in the second stage length economies.

9 The potential savings may be improved if the following two modifications to the reallocation plan are implemented:

1. CP Air's ray average cost per adjusted output was increased by the reallocation probably because the reallocation increased the proportion of charter services to an excessive level when CP Air's output mix was probably close to the optimal one before the reallocation. Therefore, in order to improve cost efficiency, the adjustment in size of CP Air should be done by reducing both the scheduled and charter services a similar proportion.

2. Among the regional carriers, Quebecair had the smallest percentage decline in its ray average cost after the reallocation. This is most likely because the reallocation reserved Quebecair's specialization on charter services by increasing its scheduled services. Therefore, to achieve higher cost efficiency the reallocation of the scheduled services from the trunks to the regionals should take into account the output-mix positions, and not be based solely on the current output level of the scheduled services.

In other words, one needs to maintain the cost advantages of specialization in either the scheduled services or the charter services with the complementary role of the non-specialized services to reduce the underutilization of inputs.

BIBLIOGRAPHY

Baumol, W.J. "On the Proper Cost Tests for Natural Monopoly in a Multi-product Industry," American Economic Review, Vol. 67, No. 5 (December 1977), pp. 809-822.

Baumol, W.J. "Contestable Markets: An Uprising in the Theory of Industrial Structure," American Economic Review, Vol. 72 (1982), pp. 1-15.

Baumol, W.J.; Bailey, E.E. and Willig, R.D., "Weak Invisible Hand Theorems on the Sustainability of Multiproduct Natural Monopoly," American Economic Review, Vol. 67, No. 3 (1977), pp. 350-365.

Baumol, W.J. and Braunstein, Y.M., "Empirical Study of Scale Economies and Production Complementarity: The Case of Journal Publication," Journal of Political Economy, Vol. 85 (1977), pp. 1037-1048.

Berndt, E.R. and Khaled, M.S., "Parametric Productivity Measurement and Choice Among Flexible Functional Forms," Journal of Political Economy, Vol. 87, No. 6 (1979), pp. 1220-1245.

Caves, R.E. Air Transport and Its Regulators. Cambridge: Harvard University Press, 1962.

Caves, D.; Christensen, L.K. and Thretheway, M.W., "Re-examination of Scale Economies for U.S. Trunk Airlines," Social Systems Research Institute Discussion Paper No. 8028, University of Wisconsin - Madison, (December 1980).

Douglas, G.W. and Miller, J.C., III. "Quality Competition Industry Equilibrium, and Efficiency in the Price-Constrained Airline Market," A.E.R., (September 1974), pp. 657-669.

Fuss, M. and Waverman, L., "Multi-product Multi-input Cost Functions for a Regulated Utility: The Case of Telecommunications in Canada," Institute of Policy Analysis Report No. 7810, University of Toronto, 1978.

Fuss, M. and Waverman, L., The Regulation of Telecommunications in Canada. Economic Council of Canada, 1981.

Gillen, D.W. and Oum, T.H., "Cost Structures of the Canadian Airline Industry," Working Paper 82-22. School of Business, Queen's University, 1982.

Gillen, D.W. and Oum, T.H., Cost, Efficiency and Productivity: The Canadian Airline Industry Under Regulation. A monograph written for the Institute for Research on Public Policy (IRPP), forthcoming in 1983.

Jordan, W.A. "Airline Performance Under Regulation: Canada vs the United States," J. of Law and Economics, Vol. 1 (1979), pp. 35-79.

Keeler, T.E. "Airline Regulation and Market Performance," Bell Journal of Economics, (Fall 1972), pp. 399-424.

Nadiri, M.I. and Shankerman, M.A., "The Structure of Production, Technological Change, and the Rate of Growth of Total Factor Productivity," Working Paper No. 358, NBER (June 1979).

Panzar, J.C. and Willig, R.D., "Economies of Scale in Multiproduct Production," Quarterly Journal of Economics, (1977) 481-493.

Reschenthaler, G.B. and Roberts, B. (ed.) Perspectives on Canadian Airline Regulation. (Institute of Research on Public Policy, 1979).

Roy, R. "Economies of Scale in the Airline Industry," Research Branch Report No. 10-80-06. Canadian Transport Commission (1980).

Straszheim, Mahlon. The International Airline Industry. The Bookings Institution, (1969).

Willig, R.D. "Multiproduct Technology and Market Share," American Economic Review, Vol. 69, No. 2 (1979), pp. 346-351.

WESTERN CANADIAN TRANSPORTATION PROBLEMS AND OPPORTUNITIES

A Bulk Shipper's Perspective

by

K.B. Doyle and W.A. Tett
President and Vice-President,
Sultran Ltd.
Calgary, Alberta

WESTERN CANADIAN TRANSPORTATION PROBLEMS AND OPPORTUNITIES
A Bulk Shipper's Perspective*

I. INTRODUCTION

This presentation is intended to provide:

(1) background on the Canadian sulphur industry and its position in world markets;

(2) background on the function and position of Sultran Ltd., in the Canadian sulphur industry;

(3) a view of the Western Canadian transportation scene from the perspective of a large bulk shipper, with specific comments on the carriage of grain, rail capacity, the National Transportation Act, and their respective contributions to present transportation problems; and

(4) recommendations for changes in transportation policy and legislation which should allow Western Canada to take full advantage of opportunities that will come in the next two decades.

II. THE SULPHUR INDUSTRY

Production

Over 90% of Canada's sulphur is produced in Alberta from the processing of sour natural gas and tar sands. Northeastern British Columbia also produces some sulphur from natural gas.

Production of sulphur in Western Canada grew from less than a million tonnes annually in the early sixties to a peak of 7.1 million tonnes in 1973. It declined steadily thereafter to a level of 5.9 million tonnes in 1981 and is expected to remain around this level for the next few years.

Block Inventory

Canada has the largest accumulation of sulphur inventory in the world.

Until 1980, Western Canadian sulphur sales in all markets were consistently less than the amount of sulphur produced annually. Because sulphur production was involuntary, the excess of production over sales accumulated in stockpiles. These stockpiles, otherwise known as blocks or vats, grew during the sixties and seventies to a total of 20.5 million tonnes. Of this total, about 80% is located at railroad connected plants for reasonable access to the marketplace.

In 1980, for the first time, through a combination of declining production and annually increasing sales, total sales of sulphur exceeded production by about two million tonnes. The difference was made up of block

---

* This paper was presented to the Canadian Transport Commission on March 23, 1983.

or vat remelt. The rate of remelt was about the same in 1981, but as a result of the worldwide recession, 1982 net remelting was just under one million tonnes.

These blocks or vats will continue to be remelted throughout the eighties as market conditions dictate.

Markets

Sulphur is used in a wide number of industrial activities including the manufacture of paper, steel, chemicals, and paints. However, its most important use is in the manufacture of fertilizers; about 50% of the world's production of sulphur is used for this purpose, while Canadian sales for agricultural purposes are closer to 70% of total sales.

Canada has become the largest exporter of sulphur in the world and currently exports more than one-third of the total sulphur traded internationally. It is worthwhile to examine how markets have developed for Canadian sulphur since the mid-sixties when the industry began to market in volume.

SALES OF CANADIAN SULPHUR BY MAJOR MARKET AREA
(Percentages are of total sales)

	1966	1976	1981
Canada (%)	34.4	15.3	12.8
U.S.A. (%)	38.7	23.3	20.3
Offshore (%)	26.9	61.4	66.9
Total (%)	100	100	100
Total Tonnes Sold	1.75MM	3.98MM	8.37MM

In both percentage share and volumes, the offshore export market has been the most significant for Canadian sulphur. Actually, the Canadian and American markets have declined in terms of market share, although overall volumes have increased over the past 15 years. It is expected that the trends indicated in the above table may continue. However, overall volume growth in the next decade will be much less dramatic than in the past. It is quite obvious that the offshore export market has been, is, and will continue to be the most important market area for Canada.

Sulphur in Ground Reserves and the Future

While sulphur production is declining at existing plants and will continue to do so for the next 20 years, Western Canada has significant reserves of sulphur in the ground. Most of these reserves are found in sour gas in the foothills of Alberta, and the Tar Sands in the northeastern part of the province.

The Alberta Energy Resources Conservation Board, the provincial regulatory authority, calculates that there are 300 million tonnes of established sulphur reserves in Alberta and much more than that in probable ultimate reserves.

Several discoveries have been made of sour gas wells with (H_2S) content of over 80%. These discoveries, when economics and technology allow, will be exploited as sulphur wells rather than gas wells. Production capabilities from some of these wells could exceed one million tonnes per annum.

Sulphur consumption in the world has been growing at about 3-4% compounded annually in the long term. If Canada was to maintain its present market share, there would be a potential to export up to 12 million tonnes of sulphur annually by the year 2000 A.D.

Clearly, reserves and market potential indicate there is a good future for Canada in sulphur, with the proper economic conditions allowing this future to develop.

Size and Location of Gas Plants with Sulphur Production

Natural gas is most typically found on the eastern side of the Rockies, both the immediately adjacent foothills country, and further east in the plains country. Gas plants are located north of the U.S./Alberta border about 1 200 kilometres from Grande Prairie, Alberta and Fort St. John, B.C. Within this area of about 420 000 square kilometres, there are over 50 gas plants producing sulphur.

Twenty-seven of these plants are located on rail and 23 are not. There are currently 14 of the larger rail connected plants designated as export plants. Non-rail connected plants are normally served by road.

The long distances between plants and tidewater terminals are perhaps the most significant element in operations and costs. Alberta and B.C. plants are located on the average about 1 400 kilometres from tidewater via rail.

Canadian Sulphur Logistics

Good logistics management has always been the key to successful exploitation and accessing of Canadian sulphur. The logistics are complex and costly for all three market areas i.e., Canada, U.S. and offshore. However, the larger faster growing offshore market area is the most difficult and costly to access because of the climate, terrain, distances involved and offshore competition. Canada's major competitors enjoy significant logistical advantages.

The Comparative Logistical Position of Major Sulphur Export Countries

Canada competes for export sulphur markets with five other major producing countries such as: Poland, France, United States, Mexico and Saudi Arabia. These countries produce export sulphur at plants located relatively close to tidewater in comparison with Canada.

AVERAGE DISTANCES FROM EXPORT PLANTS TO PORTS OF EXPORT

	Country	Average Distance (km)	Export Port
(1)	Canada	1 371	Vancouver
(2)	Poland	500	Gdansk
(3)	U.S.A.	288	Galveston
(4)	Saudi Arabia	208	Jubail
(5)	France	92	Bayonne
(6)	Mexico	45	Coatzacoalcos

Ocean distances to offshore markets are another factor when considering Canada's competitive position vis-à-vis other countries. As ocean freights are based primarily on daily ship costs, distance comparison is a good yardstick to compare Canada's relative marine position.

It may be noted from the following table, that Canada has a marine distance advantage only in the Far East and New Zealand. In relation to other parts of the world such as Western Europe, Africa and India, Canada is at a significant disadvantage.

MARINE DISTANCES IN NAUTICAL MILES TO TYPICAL DESTINATIONS

Typical Destinations	Vancouver Canada	Galveston U.S.A.	Coatzacoalcos Mexico	Gdansk Poland	Bayonne France	Jubail S. Arabia
Rotterdam, Neth.	8 868**	5 123	5 172	662*	794	6 350
Durban, S.A.	11 324**	8 077	8 010	7 573	6 567	4 187*
Bombay, India	9 512	9 725	9 774**	6 954	5 973	1 272*
Pusan, S. Korea	4 623*	9 737	9 621	11 342**	10 361	6 351
Wellington, N.Z.	6 447*	8 041	7 925	11 945**	11 069	8 100
Safi, Morocco	8 276**	4 596	4 645	2 121	1 014*	5 268
Sfax, Tunisia	9 311**	5 649	5 698	2 878	1 897*	4 400

* shortest distance ** longest distance

Overall, Canada is at a logistical disadvantage compared to its major competitors in its most important market area--the offshore marketplace.

Organization of the Canadian Sulphur Industry

In the oil and gas industry, logistics have always been an important and expensive consideration in reaching markets. Oil, gas and sulphur are generally found in more remote areas and the industry recognized that cooperation was essential on logistics if resources were to be profitably

accessed. Pipelines and other common distribution systems and facilities have resulted from this cooperation.

It was logical that this same cooperation on logistics would extend to sulphur, particularly when the long distances to port and the rugged terrain in Western Canada made any other way impossible, except to the very largest producers. It was for these reasons that the Canadian industry eventually created Sultran Ltd., which was organized to manage and improve the logistics system for export sulphur.

Sultran Background

Sultran Ltd. is a logistics service company based in Calgary with offices in Whitecourt and Vancouver. It is owned by 20 producers of sulphur and provides transportation, terminalling and other logistics services to shippers of export sulphur.

The company's services are available to any interested shipper and are normally provided on a contract basis. Sultran publishes tariffs setting out rates, terms and conditions for providing services and like other companies, endeavours to make a profit.

The company currently handles sulphur from 14 export plants in Alberta and Northeastern British Columbia. All of this sulphur is presently shipped through the port of Vancouver, although when economic circumstances have permitted, the ports of Thunder Bay, Québec and Churchill have been used.

In 1976, when the company was organized, it handled 2.3 million tonnes. The volumes grew steadily until, and including 1981 when 5.5 million tonnes were handled. In 1982, the worldwide recession caused a significant volume reduction to 4.6 million tonnes.

Sultran's rail transportation bill is currently in the order of $130 million annually and is split about 60-40 between CN and CP rail, respectively. Sulphur rail activities are primarily, but not entirely, trainload or unit train operations. There is an average of 15 train sets of 85 cars each in operation on CN and CP rail at any one time, carrying sulphur to export positions. Sultran owns 680 bathtub gondola cars of 93 tonnes capacity each, which represents the equivalent of 8 train sets. The cars for the remaining 7 train sets are provided by the railways. Sultran is one of the largest volume shippers on the two transcontinental rail lines through the mountains to the West Coast.

Rail Transportation in Western Canada

Three major factors have significantly influenced rail transportation in the West during the past 15 years.

The first, is the growth in the total volume of all commodities moving over rail lines in Western Canada during the period 1967-1982, which has posed serious rail capacity problems for the future.

Second, is that the carriage of grain at the statutory Crow Rates during this period became a serious problem, in that rail costs eventually far exceeded the statutory rate of about $0.005/ton-mile.

The third factor, is the partial implementation of a new transportation policy in the form of the National Transportation Act of 1967 which has had significant effects on rail transportation.

These three factors together have brought about major changes, and have caused some major problems, in western transportation. The present situation calls for some further changes and provides some opportunities for Canada to continue developing an adequate and efficient transportation system. This further development must, however, be done at costs that will permit continued growth in volumes of the many commodities, mainly exports, handled via rail in Western Canada. This continued growth is essential if Canadians are to be employed and are to enjoy a reasonable standard of living.

Although the three major factors indicated are closely linked, it is worthwhile to examine them separately.

Volume Growth 1967-1981

It is difficult to pinpoint historic volumes of commodities handled in Western Canada in meaningful terms. However, since the principal volume-related problems are primarily on the two main transcontinental lines to the West Coast, a comparison of major bulk exports through the Canadian West Coast ports gives some indication of volume growth.

BULK EXPORTS, CANADIAN WEST COAST PORTS
(millions of tonnes)

	1967	1981	Percentage Change
Coal	1.1	15.6	1 388
Grain	4.5	10.4	131
Sulphur	0.9	5.6	526
Potash	1.1	3.0	161
Total of 4 commodities	7.6	34.6	357

While coal shows the most dramatic growth of the four major commodities at 1 388% in 15 years, all commodities have grown substantially.

This growth represents an average increase over 15 years of about 10.7% compounded annually. Inevitably, this rate of growth over a prolonged period has created capacity problems. Rail capacity first became a real concern in 1974 on the main lines through the mountains. This concern submerged during the recession of 1975 and did not reappear as a major issue until about 1980

when annually increasing volumes caused the spectre of rail rationing to the West Coast. Considerable additions to capacity had taken place during the seventies, but not enough to meet the growth in volumes projected for the future.

By 1981, the two transcontinental main lines handled in excess of 50 million tonnes of westbound commodities annually, with expectations of even more dramatic growth during the eighties. That growth was postponed with the arrival of the recession in 1982 and 1983. However, there can be no doubt that, as in the past, that volume growth will resume.

In recent years, Western Canadian shippers have been increasingly aware of the growing threat and impact of rail rationing on their businesses, and of the fragility of the western transportation system. The loss of the Second Narrows Bridge in October 1979 served to demonstrate that fragility to the public at large. However, many other less spectacular incidents over the years have made this a fact of life for western shippers, and adjustments had to be made. Most commodities have increased their surge storage capacity at the tidewater terminals, and have employed extra cars to deal with disruptions. In recent years, most shippers can point to increased ship and rail demurrage and detention bills caused by this fragility. This has occurred even as the railways have made great strides to improve roadbed and main line trackage, as well as overall operations. It is a direct result of a system operating at close to practical capacity, where every small incident on the main line can become magnified. It will become even more critical later in the eighties, because at times the system will likely be operating at close to, or even exceeding, practical capacity.

Unless significant new rail capacity is put in place soon, it will affect businesses in three ways:

(1) Investment decisions will be delayed or not made. No company will invest large sums in a coal mine or any other operation if there is no reasonable assurance of available rail capacity;

(2) Canada's offshore customers will become increasingly uncertain of Canadian commodities being delivered from a rail system operating at, or near, capacity; and

(3) Employment in Canada will suffer. Jobs come from healthy industries that are growing and expanding.

Carriage of Grain at Crow Rates

Grain has always formed a major part of the rail tonnage handled in Western Canada. In 1967, it represented more than half of the total exports of the major bulk commodities through the West Coast. In 1981, grain still represented a respectable 30% or so of these exports.

During the sixties, if grain was carried at a loss under the Crow Rates, it was not readily evident. During the late sixties and early seventies, the railways were publishing rates on unit train movements of other commodities that were on the same general level of about $0.005/ton-mile. For example,

CPR and CNR published a negotiated sulphur export trainload rate in April 1970 at $5.12/ton. This represented about $.0062/ton-mile from the sulphur plants to which it applied. Coal export rates were similarly low from B.C. and Alberta origins to Vancouver for export. All this indicates is that grain, even though it was handled very differently, probably did not represent a major cost burden to the railways in 1967.

That situation changed dramatically in the seventies as railway costs escalated sharply from inflation, fuel price increases and the need to add additional rail capacity. In the eighties, rail unit train rates on the highly efficient large volume commodities like coal, sulphur, and potash, are in excess of $0.02/ton-mile.

During the seventies, the railways turned to other commodities in Western Canada to make up revenue shortfalls experienced on grain. The western commodities were particularly vulnerable because in practical terms they were captive to rail. There was, and still is no economic alternative to move the large volumes over the long distances involved.

Despite rapidly increasing rail freight rates, Western Canadian commodity shippers, for the most part, continued to grow and expand during the seventies. However, the situation has changed dramatically in the early eighties, as all commodity shippers have experienced significant downturns in volumes and prices, mainly because of the worldwide recession.

However, there are some other underlying reasons for these recent changes. There has been a growing competition from other countries for offshore markets in almost all commodities. At the same time, the costs of bringing new production on stream for coal, sulphur, potash and other commodities has skyrocketed. For instance, to bring one tonne of annual sulphur production capacity on stream in 1967 cost about $35 in capital expenditures. In 1983, that same cost is more in the order of $225 per tonne of production capacity. Operating costs have followed a similar escalation.

Additional railway capacity is required to meet the shippers' forecast needs to the year 2000 A.D., but that capacity will only be required if shippers can afford the cost of putting it in place. All commodities including grain must contribute to cover these costs so that the required rail capacity can be provided at affordable costs. As well, it is important that all commodities use that capacity in the most efficient way possible. For most commodities, railway pricing techniques are designed to encourage this. The lower rates for trainload and unit train operations as well as an array of penalty charges, have induced commodity shippers to become highly efficient in their use of the rail system.

Grain has been denied exposure to the full costs of the system including the cost of railcars, demurrage and detention, gathering costs and the like. Until the full costs of moving grain are completely exposed and the responsibility of one agency, it is unlikely that it will move in an optimal way. The grain system is a complex one and is not simply a transportation problem or a car allocation problem. It is a logistics problem that begins at the producer's farm and ends with the ultimate customer; it must be managed as such by one agency with the proper authority and responsibility if

the rail transportation issues are to be dealt with effectively. It will be important as well, if the government continues to subsidize grain transportation, that any subsidies are applied in such a way that does not obscure the real costs. This would be detrimental to an efficient grain system.

The problem of grain for other commodities is not simply that the rates have been below cost and have made no contribution to the rail system, it is also a problem of shared rail capacity. This problem can become acute in rail yards and terminals and in winter and other times of restricted capacity on the main rail lines. Inefficient movement of grain uses rail capacity beyond its real needs and this periodically affects the ability to move other commodities.

The federal government is to be commended for its important and responsible initiatives on the Crow Rate. It should be recognized, however, that these initiatives represent just a beginning and it is to be fervently hoped that the government will not stop here.

III. THE NATIONAL TRANSPORTATION ACT OF 1967 AND SHIPPER EXPERIENCE UNDER LIMITED ECONOMIC REGULATION

The Act of 1967 brought about some significant long-term changes in rail transportation - most of them good for the country and the railroads. The benefits that have emerged under the National Transportation Act (NTA) are such that even western shippers would not suggest turning the clock back. However, most western rail shippers would propose some refinement and evolution of transport legislation and regulation.

The creation of the NTA was based on the premise that competition was ultimately the best regulator of rail transport pricing, and therefore, minimal protection was built into legislation in order to deal with situations where there was no effective competitive feature to act as a regulator.

In the sixties, transportation in Canada was dominated by the industrial heartland based in Ontario and Quebec where both intermodal and market competitive forces were strong. The resource sector based in the more remote parts of Canada, including the West, was important but not dominant with the exception of grain. No doubt this fact influenced the MacPherson Commission's views on competition as the best regulator of rail pricing.

Since the sixties, the resource sector has grown enormously, particularly in Western Canada. This resource sector is export oriented, is generally located long distances from tidewater, and is captive to rail transportation. The cost of freight is a critically important factor to this resource sector where transportation charges often exceed 25% of the FOB plant values.

With this development of resources, the volume of non-competitive traffic carried by the railways has steadily increased. As a result, the reliance on competition to ensure reasonable rates has become less and less applicable to this rapidly growing portion of the railways' business, and

perhaps is rendering some of the underlying rationale and philosophy of the MacPherson Commission and the National Transportation Act, somewhat out of date.

It is worth considering what "competitive", in practical terms, really means. In the commercial marketplace, the railways will react to only two things, 1) intermodal competition, and 2) product market competition. They will react because if either exists, the railways may lose business.

Intermodal competition does not exist for most bulk commodities in Western Canada by virtue of the distances and large volumes involved. These conditions make commodities, such as sulphur, captive to the rail mode in the real practical sense. There is, therefore, no protection from intermodal competition.

The railways will perceive market competition to be competition from other sources such as the U.S.A., Poland or France, and will only respond when a shipper can show that the rates being charged are having the effect of constraining shipments, thereby causing loss of railway traffic. Even in this situation, the governing perception of market competition is that of the carrier; it has the right to decide not only whether the market competition is of sufficient importance to its interests, thereby warranting response, but also to decide finally on a division of the profits from the sale of a commodity, between the transportation of that commodity and the producer. This power amounts to the ability to "tax" the movement of captive commodities, sharing in returns of the shipper without necessarily assuming any of the liabilities. Market competition for the captive shipper is unlikely to effectively constrain railway freight rates in any meaningful way.

Captive Shipper Rail Rate Negotiations

The railways will argue that they negotiate every year with shippers on freight rate levels and conditions of carriage. The significant question, however, is how meaningful those negotiations really are. Rate negotiations between the parties in captive situations is a process whereby the carrier indicates a percentage increase it wishes to apply, or which carriers jointly wish to apply, and which is usually higher than they expect to get. It is then up to the shipper to ascertain the actual increase the carriers really want. The railways are in complete control of the process, provide little or no meaningful information, and refuse to discuss their costs. The shippers never get a complete picture. The railways only disclose those elements of cost changes which support their position. The result is that the information a shipper gets is incomplete, discontinuous, and of little use in terms of bargaining with the railways. The railways will only agree ultimately to accept what they want, and if necessary will publish rates without shipper concurrence.

Whether or not particular rates at this point in time are excessive from an economic or financial viewpoint is irrelevant. What is relevant is that in the absence of effective legislation and the administration of that legislation, the railways have the ability to impose their own unilaterally determined freight rate levels and increases on captive commodities. It is

this unilateral power to set freight rates without real restraint that is objectionable.

While the railways might argue that they do not earn an adequate rate of return overall, most resource shippers believe that the contribution that they are required to pay is very high. These same shippers would agree that the carriers are entitled to earn a reasonable profit on the carriage of their commodities, but a range of opinions would emerge on what constitutes a reasonable profit.

They would also agree that meaningful negotiations between the parties are the best way, in an imperfect world, to determine the appropriate transportation rate and profit margin. Most captive shippers also believe, however, that the current system of rate setting is too one-sided in favour of the railways.

Recommended Improvements of Administrative Procedures under Section 23

The Railway Act and the NTA offered shippers two means of appeal for rail pricing actions; one way is to have a rate set under the captive shipper provision, but shippers have come to regard the formula under this provision as useless. It is significant that no rate has ever been established in this manner during the past 16 years.

The other means of appeal is to apply under section 23 of the NTA and try to equate the complaint to the public interest. As far as section 23 is concerned, shippers do not know what "the public interest" may mean in the context of their problem, and believe the process of finding out is too long, risky and costly. They also believe section 23 is not likely to provide much relief, and furthermore that whatever relief they do get will not be retroactive.

The focus of disputes, among the relatively few cases brought before the Canadian Transport Commission (CTC) under section 23, has been largely on the impact of rates on a shipper's business. There have been cases where rate relationships have been introduced, but not cases that have addressed the issue of railway costs, the appropriateness of contribution or whether a rate, or a rate increase, reflects the efficiency of rail movement.

Section 23 cases initially took from three to seven years to be resolved. It is evident, however, that the CTC is making serious efforts to speed up cases coming before it, and the improvement has been dramatic. But realistically, a shipper has to consider 9-12 months as a minimum period of time in which to deal with a section 23 case at a cost of perhaps several hundred thousand dollars. When a decision is reached, if it is favourable to the shipper, there is no history of rate rollback or penalties to the carrier. Clearly, it serves the carriers' interests to ensure that a section 23 case takes as long as possible.

In the captive shipper's view, one way of correcting the situation and creating a more balanced negotiating environment, is to make section 23 more effective. It is recognized that a section 23 case is significant for any shipper to undertake and that the shipper must be prepared to commit his

resources to the undertaking. However, the Commission can do some things to enhance the effectiveness of section 23 actions, and thereby make its use a more readily available recourse in resolving grievances. Such actions are as follows:

(1) At the earliest stage, the Commission should call all the parties together informally, and advise them of the matters they wish the parties to address, in particular, so that the process can be made concise.

(2) The Commission should bend over backwards to move expeditiously. It may well be a problem of perception, but it is up to the CTC to give the impression that prompt action is being taken.

(3) To the extent that the Commission can inform the parties of the investigation and procedures it will follow, it should do so clearly and concisely.

(4) Section 23(4) gives the Commission the broadest possible jurisdiction. This jurisdiction should be used to order refunds or retroactive relief for successful shippers in appropriate cases. The wording in this section appears to give the Commission the right to do this. In this way shippers are fairly compensated, and the railways have no benefit of delays. Frankly, any railway is encouraged to delay a matter as long as possible under circumstances as they are presently perceived.

If the CTC follows these suggestions, it will accomplish two things: 1) it will make section 23 more effective and 2) it will represent a major step towards correcting the current imbalance which exists between a captive shipper and a railway during the negotiation process.

However, one additional, very essential element is needed to ensure that the imbalance in negotiations is corrected; the Commission must be prepared to look at railway costs, and assess, in specific cases, appropriate markups.

In 1983, the rail carriers should be transporting grain at rates yielding a contribution to constant costs. By 1986, the contribution will be 20%. Passenger traffic is already yielding at least long-run variable costs, so in the future the carriers, should have no traffic moving at less than long-run variable costs. Recent Snavely studies indicated that a required contribution for CN and CP was about 35% and 24%, respectively for 1980, allowing for full recovery of their capital costs.

How much any particular traffic should pay is not something that can be determined with precision, but the Commission is now sufficiently sophisticated to deal with appropriate cases under section 23. It should be willing to determine what it considers to be a reasonable contribution, given the location and volume of the traffic concerned, scale of operation and service required, etc.

The suggestions in this presentation, rather than increasing the number of section 23 cases in the long run, would render the negotiation process between carrier and captive shipper more meaningful and balanced; the

carriers would have to respond to a shipper's need to understand and believe that a reasonable rate is being charged. The negotiating process would become more effective, and ultimately result in fewer complaints.

The alternative to the suggestions presented would be legislative changes to the NTA and the Railway Act. Two efforts have been made at legislative change in recent years in the form of Bills C-20 and C-33. They represented what many shippers believe is the greatest danger of legislative change - the tendency to overlegislate. It is hoped that through the fullest interpretation of the NTA and some administrative changes by the CTC, the most serious concerns of captive shippers may be dealt with in an acceptable way.

IV. SUMMARY

Canada currently faces severe economic difficulties. Its resources will, in future, point the way to resolving some of these difficulties by expanding world markets; many of these resources are in Western Canada and rely on rail transportation to reach export markets. Rail capacity must be expanded at significant cost to allow exports and the economy to grow in the next two decades.

Canadian transport policies, aided by strong and resourceful railways have served this country very well in its development in the past. They can continue to do so in the future, if positive actions are taken. Some are already underway, such as the revision of the Crow Rate. Other actions in transport policy and regulation are recommended in this presentation, and if they are taken, will contribute in a major way to a healthy economy for Canada in the future without having to go the legislative route.

PASSENGER TRANSPORT INTERCONNECTIONS, RIGHTS-OF-WAY AND REGULATION

by

David McQueen
Professor of Economics
Glendon College
York University, Toronto

PASSENGER TRANSPORT INTERCONNECTIONS, RIGHTS-OF-WAY AND REGULATION*

Being a train watcher, of course, is something you have to learn to grow away from, somewhat, once you become an economist. You must try not to let it cloud your judgement. A man who, I think, has handled this problem is Professor George Hilton in the United States -- a transport economist yet a railway fan. His writings veer from nostalgic recollections of Pennsylvania K-4 steamers to a very hard-nosed attitude towards rail transport in general. I try to emulate him, in this respect, to some degree, even if I suspect that the degree would leave him thinking me a hopeless, sentimental, political compromiser.

I have entitled this talk "Passenger Transport Interconnections, Rights-of-Way and Regulations". Its character has been motivated by some concerned observation -- some part of it, I must admit, rather casual observation during a regular journey to work along (and alongside) some major transportation facilities in the Windsor/Québec corridor. But some of it, too, reflects concerned observation of recent public debate on energy and common-carrier passenger transport in Canada.

It seems to me that some important economics relevant to this debate is getting pushed too much to one side. As a result, we may end up committing ourselves to some very expensive errors (not, alas, a new phenomenon) in this field, while at the same time omitting to do some much less expensive things that could improve, very usefully, the togetherness, efficacy and efficiency of our passenger common-carrier network.

As "pushed-aside economics", I have in mind particularly facts concerning the economic value of efficient modal interfaces -- the sort of thing exemplified by some of the better subway/bus interfaces in the Toronto Transit System. I have in mind also the value of exclusive rights-of-way. Finally, I will, in addition, express some concerns about what I shall call the "on-off, either-or" approach to energy conservation, about the "home-hardware" protectionist syndrome, and about the "H.O.-Empire Capital-Intensity Bias" in transport planning. I will explain the more exotic-sounding of these syndromes shortly.

I want to discuss all these things with you in a fairly speculative way, because the data that I have so far been able to examine are not very comprehensive. Maybe even "discuss" is too assertive a word. What I really want to do at this stage is simply to urge you to give more attention to these matters in your future data-generation and analysis.

I want to bring up these matters with major references, first, to buses, and then to trains, -- or, if you prefer, "guided ground vehicles".

---

* This paper was presented to the Canadian Transport Commission on April 29, 1983.

Like all economists trying to be reasonably rigorous within a one hour time constraint, I must first burden you with some big assumptions. The first of these concerns energy. Before getting to it, however, let us have quite clear in all our minds that energy is only one of the inputs -- only one of the costs -- in transportation. Proper efficiency analysis always looks to all costs, including such things as labour costs, capital costs and land costs. I will be saying quite a bit about the latter, and also about passenger time-costs. Some of these other costs can come on very strong in certain situations, as we know. For example, I would want very heavy odds indeed to put any money at all on the prediction that energy costs will rise enough in my lifetime to offset the time-cost saving for most people going from Toronto to Winnipeg or Vancouver by plane.

That said, I am going to assume that the "energy crisis", though it has relaxed its grip on us somewhat for the time being, will in due course return. It may even, as it did before, erupt again quite suddenly -- as a proximate consequence, for example, of fresh political explosions in the Middle East. Therefore, although, as I have said, the overall efficiency of passenger common-carrier transport should preoccupy us at all times, we continue to have special energy reasons for emphasizing this preoccupation today. From my basic energy assumption, follows the guess that we will do well to maintain some policy tilt, above and beyond the pressures generated by immediate market price signals, towards the conservation of non-renewable energy. Not only should we be trying further to economize on energy, we should also be doing what we reasonably can to be in a position to economize still more on rather short notice, in case of emergency.

I am sure many of you will recognize, I am of course here begging some enormous questions of how much economizing, and at what cost. But having only an hour, and lacking some key data which I hope some of you people and your colleagues will be induced to generate, I shall merely observe that stimulating new thinking about ways of keeping down the costs of forward-looking energy-economizing is one major object of this paper, and so press on.

Conserving energy and being in a position to conserve still more: now, there are many ways of doing this in the field of passenger transport. They range all the way from improving the energy-efficiency of specific air and ground vehicles to much more long-run options, such as restructuring communications networks and metropolitan land-use patterns so as to eliminate much of the shuttling to and fro of people and goods that we feel compelled to do today. There are, we must note, a lot of feedback relationships in all this. If, for example, we can improve the efficiency and attractiveness of common-carrier services, both urban and interurban, this will in turn have some tendency to encourage denser, more compact and less transportation generating patterns of urban land use.

Obviously, we can look at only a small part of this today. I am going to be focusing on network relationships, and on mostly short to medium transportation stage-lengths. I am going to talk about improving efficiency in these areas, on the basis that this will normally involve important savings also in energy use -- mainly through diversion of traffic from

private automobiles and taxis to buses and other vehicles capable of producing passenger-miles at lower energy costs and lower total costs.

Please be assured that I am not just emotionally "against" automobiles. Living in the country as I now do, I cannot afford to be! More generally, my earlier point about time-costs holds. For certain trips, the time-cost savings of private cars are, and will doubtless remain for a long time to come, formidable and overriding. What I am against, as an economist, is having to use cars for certain trips merely because some fundamentally more efficient mode or modes for the immediate transportation purpose in hand have not got their acts together properly.

One further assumption called for is a very big one, and maybe even a dangerous one to make in a House of Regulation! Be warned that I used to work in the combines policy area, and still do, on occasion. The assumption is that governments at all levels will become persuaded, partly from practical experience in the United States, that general deregulation of pricing and entry in air and bus transport will yield us big efficiency gains. I am not going to argue the point here, unless of course we want to get into it in the discussion period. Others have already argued it ably, including notably Bill Jordan and Gil Reschenthaler in their airline and bus studies for Consumer and Corporate Affairs, and Combine Director Lawson Hunter in a recent, very interesting speech at the University of New Brunswick.*

Deregulating busing means, as I see it, relatively more use of one of the most energy-conserving vehicles that we currently have.** Aircraft are relative energy-guzzlers compared with other modes, but as mentioned earlier, time-cost (plus other factors) make them a strongly preferred mode for the many stage lengths, particularly longer one. Deregulated airlines do, moreover, tend to run their aircraft fuller, and in this and other ways, squeeze more passenger-miles out of a hundred litres of fuel than they do in regulated environments.

Thus, in the broad picture, I am very much for transport deregulation. Yet today, I shall be advocating certain limited, "spot" increases in state intervention in passenger transport. Is this fundamentally inconsistent? Only, I suggest, from the kind of feverishly simplistic, ideological viewpoint that has become too common in economic debate recently. Are you for or against the market? Are you for or against liberty? Are you for or against big government? Be consistent!

---

* W.A. Jordan, Performance of Regulated Canadian Airlines in Domestic and Transborder Operations, (Research Monograph no. 12), and G.B. Reschenthaler, Performance Under Regulation: The Canadian Intercity Bus Industry, (Research Monograph no. 10), Consumer and Corporate Affairs Canada, Ottawa, 1982. See also notes for address by A.W. Lawson Hunter to University of New Brunswick, Fredericton, February 17, 1983, "Economic Regulation in Transportation and the Growing Need for Change", Consumer and Corporate Affairs Canada, Ottawa, 1983.

** In terms of passenger-miles per BTU, it takes a very modern, very well-loaded train to beat even a rather ordinary bus on energy conservation.

One of my favourite examples of the crazy consistency this induces occurs in a recent piece in the Financial Post by Walter Block of the Frazer Institute, in which he argues that privatization of public enterprise is always a good idea, even if the privatized corporation then goes bankrupt in its first year. Consistency that much invariant with the facts, belongs, it seems to me, to the age of faith, not of science. I prefer to have my consistencies bend more to the empirical winds. This seems to me in accord with a healthy Canadian tradition of pragmatism, and with the following observation by Lord Keynes: "We cannot therefore settle on abstract grounds, but must handle on its merits in detail what Burke termed, one of the finest problems in legislation, namely, to determine what the state ought to take upon itself to direct by the public wisdom and what it ought to leave with as little interference as possible to individual exertion."*

And so, finally, to our main business. What broadly constitutes an energy-efficient and otherwise economically efficient network of common-carrier passenger transport? I suggest three prime characteristics. First of all, it should, in due course, in the long run, support itself at the ticket window, except where persuasive reasons of "market failure", not readily remediable in the short run, or the impingement of important, widely-agree non-economic goals, can be brought forward to justify a subsidy from the Public Treasury.

Secondly, the mixture of modes and the linkages between them should be such as to confront passengers, in convenient places, with maximum practical ranges of real choice amongst modes, thus encouraging them to use whatever mode is most efficient for each of their particular trip-stages, and thus further encouraging modes to specialize appropriately as to stage-lengths and other service characteristics. This implies close attention to proper networking and interconnection. Third, full and efficient use should be made of valuable existing transport assets, such as established exclusive** rights-of-way.

Now, in what ways does our present passenger network fail to live up to these criteria? Let me start with an illustration. Granny, who no longer drives, lives in Calgary. She wants to visit some relatives in Goderich, Ontario. If the year is 1975, she travels there slowly but surely

---

* J.M. Keynes, "The End of Laissez-Faire", Essays in Persuasion, Harcourt, Brace, New York, 1932.

** Excluding people from anything, as when the Toronto Transit Commission informs you that driving your car on one of their bus-access lanes to a subway station will cost you $50, always sounds vaguely anti-democratic. At least, it does until you reflect that your ownership of your car, like all private-property rights, involves a very similar right of exclusion. The case for the TTC exclusion is like the case of an "enclosing", 16th-century landlord to exclude the village cows from wandering into his wheat, as they used to under the former, medieval, common-field system. With exclusion, he can grow a great deal more wheat for general public consumption -- just as, with exclusion, the TTC can move a lot more members of the public per hour into the subway station.

by train. Well, sort of surely. As I remember, sometimes in blizzardly weather, a transcontinental train might roll into Winnipeg as much as 54 hours late. However, let us asume that we are not in one of those times of year. Three nights and two days she spends getting to Toronto. There, with her heavy baggage checked through to Goderich, she is escorted by a porter to another platform at Union Station where she boards a train to Goderich. Travel is slow, but connections are easy and predictable.

Today, she flies to Toronto in three hours, which of course is great. But then problems arise. There is no limousine service to Goderich. Buses heading towards Goderich pass just south of the Toronto International Airport, but make no stops or connections there. If she wants to catch one of these buses, she must first transport herself and her baggage by special airport bus to the Royal York in downtown Toronto. She must then take a taxi to the downtown bus station which is some distance away from both the Royal York and Union Station, not on the subway, and not a terribly appealing place for an old lady to wait in at night. However, let us assume that after allowance for time-zone changes, it is in fact no later in Toronto than the afternoon rush hour. Her bus to Goderich, therefore fights its way out of town along crowded expressways. It passes the airport again three hours after she first arrived there.

She might have done better to take a limousine from the airport to Kitchener or Stratford, then a taxi to the bus depot in one of those places. It is doubtful, however, that her travel agent in Calgary could have predicted accurately just where and when she might make these connections. The conclusion is obvious. Granny's relatives in Goderich will save her a lot of anguish and hassle by simply driving their private car to the Toronto airport, or maybe to the London airport, and picking her up right there in the arrivals lounge. And the same thing, I might add, would hold if Granny was coming by train from Kingston to Toronto. She might press on by train to Stratford, but most likely, unless she had done much research, without knowledge of when and where in Stratford she might connect with the last bus to Goderich. Perhaps she could hire a hotel room and see a play.

Multiply this type of incident many times, and you have some of the inherently less necessary reasons why Canadians use up so much hydrocarbon just getting around. The fault is not that the Canadian bus network fails to reach Goderich and hundreds of similar places; it does. But its relationship with the airline network, the remaining train network, and even with the airline limousine network (much of which is parallel with itself) is mostly one of four solitudes. These common-carrier networks do not now conveniently connect as the pieces of the old steam railway network by and large did. Note, too, how the bus exit from downtown Toronto in the Granny story is at certain peak hours much slower than that of a train. This is because the bus has to fight so much other traffic for space on a common non-exclusive right-of-way.

Now, orphan though it is, and (partly <u>de facto</u>, partly <u>de jure</u>) outside the jurisdiction and major policy preoccupation of the CTC, the bus network is the densest, most ubiquitious common-carrier passenger network that we have in Canada. It is unglamorous and unchic, tending as it does to be associated with low-income clients and often very unattractive terminals,

both as to physical condition and to loiterers therein. When we middle-class dreamers grow visionary about passenger transport, we tend to brush the bus network aside in favour of H.O. model-railroad empires of highly capital intensive supertrains and Maglev vehicles. These have their place; I will be coming to them. But Professor Mark Frankena, in a recent study for the Ontario Economic Council, believes that he has identified an important H.O., capital-intensity, let's-play-trains bias in government-subsidization or urban transit in Ontario. We subsidize rail too heavily, buses not enough, he argues. This is both inefficient and unfair to areas not densely populated enough to justify rail or other heavy duty guided transit modes. Some of these areas bear names like London, Hamilton and Ottawa.*

In perusing some documentation in connection with the Government of Ontario's recently published long range rapid transit strategy for Metro Toronto, with particular reference to the Lakeshore route, and some of its connections and near-parallels, I was brought up short by a brief dismissive statement in one of the documents. Busways, it was stated, would not be a viable alternative for the Lakeshore considering the provincial policy on fossil fuel conservation.** Now, this is an example of the sort of "on-off, either-or" reasoning about energy that drives economists trained in the marginal tradition right up the wall. It does not apparently seem to have dawned on some people that if you can switch a substantial segment of the public from a hydrocarbon-consuming mode that produces relatively few passenger-kilometres per hundred litres to another which produces a great many more, you are conserving energy. And all this quite apart from the very real possibility that buses of the future may well have switched from hydrocarbons to some other fuel such as pure hydrogen. Do I hear some really deep political cynic whispering to us that perhaps these matters <u>have</u> dawned on some people, but Ontario Hydro is not currently a producer of bus fuel?

While in this somewhat unpleasantly cynical vein, let me express also mistrust of the "home-hardware" syndrome. The Ontario government has acquired substantial interests both in the development of passenger transport service and in the production of guided ground vehicles for these purposes. Public Choice theory suggests that if conflict occurs, and there proves to be a significant loser from this non-arm's-length relationship, the most likely candidate is the travelling public. Not to pick unfairly upon Ontario in this regard (one tends to pull examples close to home), let me draw your attention also to the non-arm's-length relationship between the federal government's interest in the manufacturer of STOL aircraft and in the

---

* M.W. Frankena, <u>Urban Transportation Financing: Theory and Policy in Ontario</u>, (Ontario Economic Council Research Studies), University of Toronto Press, Toronto, 1982.

** DeLCan, Electrack Canada, De Leuw Cather International Ltd., <u>Go Transit Lakeshore Commuter Services: Assessment of System Expansion Alternatives</u>, Toronto, July 1982, pp. 3-6, available from the Ontario Ministry of Transport and Communications. It will be appreciated that the authors of the reports were here simply conforming to an <u>a priori</u> government constraint, and that is the constraint that I am criticizing. Some further reasons were also given for not choosing buses for this particular application.

development of STOL routes. Often, a danger is that a perfectly sound vehicle will be forced, for misguided prestige reasons, into some high-profile type of service other than that for which it is best suited.

Back to buses, it would be an excellent thing if we could thoroughly cleanse our minds of various anti-bus biases. Let's be frank about it. I might drive a good many miles to see a snappy new train come bowling along the "corridor"; I doubt if I would walk a hundred yards to see a new bus do the same. But economic facts are economic facts, and one of our big transport facts, as I read the evidence, is that there is an immense amount of unexploited potential in the Canadian bus network. One of the more startling findings in Reschenthaler's report on bus deregulation is how profitable much of the present network is to the bus firms.* The rates of return on invested capital compare very favourably indeed with those of other industries. The network appears to be profitable in part because of the modal/monopolistic character of it, with new second and third entrants into various city pair bus routes being barred by provincial regulation. Reschenthaler argues, convincingly to me, that deregulation would lower price and raise volume. More of our intercity and intertown travel would then go via this energy-efficient mode.

But if I were given broad, dictatorial powers, probably ultra vires of several sections of the Charter of Rights and other parts of our Constitution, I would do some further things as well. In the stilted language of the economics classroom, after Reschenthaler was done pushing us down the existing bus-travel demand curve to lower 'P' and higher 'Q', I would act to pull into the market whole new clienteles -- especially middle-class clienteles -- and so shift the whole curve out to the right, to still higher 'Q'.

First, as already suggested, I would progressively improve inter-connections with air and rail modes -- as, for example, by providing exclusive, in-and-out bus lanes at all major airports which happen to be adjacent to major intercity road links, as most are.

I would also encourage municipal governments to provide decent, well-maintained intercity bus depots, conveniently located in relation to other transportation facilities. In Toronto, for example, the obvious place would be very close to the Union Station/Royal York confluence, which is already one of our better modal interfaces, but needs to get better still.

Generally, new and better bus depots would be conveniently located in relation to other transport facilities, would be owned by municipalities, but would be self-financed by rents from bus companies and concessionaires. Further -- this is where I get quite regulatory -- I would, subject to only a few, well-justified exceptions, such as bus-extensions of subways, require all intercity buses serving these municipalities to call in at these depots. In this way, the public would have maximum opportunity to benefit from the

---

* G.B. Reschenthaler, supra, pp. 114-115.

greater, multi-company frequency of service that free entry, lower fares and better connections would tend to bring about.*

Further still, wherever opportunity offered, as through the becoming available of old railway rights-of-way no longer needed to service industries, I would construct fences, two-lane, exclusive busways connecting central-city bus depots with peripheral highways. Only intercity and express transit buses would be allowed to use these arteries, except that off-peak rights might be offered to truckers, for a price, to aid financing. The purpose of these relatively short but important links would be to speed up service. More customers would be attracted away from private cars by giving buses some of the same, brisk, in-and-out-of-city capacity that our better trains have. Two places I would very much like to see this tried are Calgary and Edmonton.

---

* Let us pause a moment here and enquire why the market does not naturally provide more and better modal interconnections. This question could use a theoretical investigation in depth; but parts of the answer can perhaps be discerned without too much travail. A basic difficulty is that the relationship between transport modes is often a mixture of the competitive and the complementary. Take geographically separated points A, B and C. Traffic volume between A and B is too light for rail service, and buses are therefore the only common carrier. Between B and C, however, rail and bus compete. Other things equal, maximum public convenience and choice would call for a common rail/bus terminal at B. But the bus company, or the rail company, or even both, may baulk at this, out of a fear of losing B-C market share to the competing mode.

This problem can also exist <u>within</u> a multi-firm mode, as in the case of the rail mode before the auto and air ages. Partly because the relationships between different railway companies were often a mixture of competitive and complementary (although geography and the historical sequence of rail entry into various cities came into it too), we never had enough genuine union stations. In a place like Chicago, this could be particularly trying. Canadians did not have enough union stations either (Halifax, Ottawa, Toronto and Regina were the major useful exceptions), but escaped much of the problem because the two great transcontinental railroads were themselves such widely ramifying networks. In the air age, the problem is generally far less because of the scarcity of suitable land for major airports, and of the great scale economies of major airport operation. Like it or not, partly competing and partly complementary airlines have to share terminal facilities in most instances, thus making it much easier for the travelling public both to connect between them and to choose between them on the basis primarily of the price, quality and timing-convenience of their performance on competing routes.

Those wishing to explore further the complexities of competitive/complementary transport relationships will find a virtually inexhaustible source in the U.S. regulatory literature on "gateways", "friendly connections" and "short-hauling" in railway freight transport.

Premier Lougheed, among others, has talked of a fast, Japanese-style, super rail link between the two cities. I sincerely hope he doesn't do it. Before stating why, let me first say that I yield to no person in my awe at the very rapid 40-year growth rates of Calgary and Edmonton, nor in my admiration for the Japanese Shinkansen trains, on which I have travelled a couple of times. And while I have not yet had the pleasure of riding those orange French Très Grande Vitesse trains, I have long admired the completely professional and dedicated attitude that French railway men bring to running mainline passenger trains.

But I believe that if we tried to put in bullet trains between Calgary and Edmonton, we would not achieve enough service frequency to be adequately competitive with Pacific Western Airlines' (PWA) shuttle, which would mean big rail deficits. For all their extraordinary postwar growth, Calgary and Edmonton are still well short of the massive size required to make a once-an-hour train service pay. As will be indicated later, there are some very real doubts as to whether even Toronto and Montréal are over that size threshold, or likely to be in the medium-term future.

We could however, achieve PWA-competitive frequency between Calgary and Edmonton with super-buses. Given the modest distance to be covered (significantly, only about half the Toronto-Montréal distance), plus new, exclusive, high-speed bus access-links to the city centres at each end of the run, a three-hour service on a one-hour frequency would be achievable at far less cost than that of putting in a whole new rail line. Over much the greater part of the distance, an excellent, heavy duty highway is already in place. By contrast, the present rail though more than just a country-elevator branch, is clearly not up to bullet trains at all.

Calgary-Edmonton could be the perfect run on which to try out some articulated monster buses with premium-price, first class sections, including mini-bar service. They could make brief intermediate stops at the two international airports. The possibilities of shifting the bus demand curve outward in Alberta are particularly interesting -- all the more so because of the looser regulatory environment as to pricing and entry. Instead of problem trains, the world's best intercity bus service: it's worth thinking about.

But now back to trains -- some other ones -- again. Our passenger trains in Canada are nothing if not picturesque. Last evening, as part of my preparation for this session, I came to Ottawa on a train from Toronto that did not pause except for a half hour of mysterious and disconcerting switching in Brockville. That much was progress, even if it has never been clear to me (after glancing briefly at a railway map of Canada) why the best train between two of our largest cities must still go the great circle route via Brockville.

After Brockville, however, the slow trundle up the old lumber line to Smith Falls last night was much as it has been since, I suppose, Confederation. Leaving Smith Falls, moreover, this sleek guided vehicle -- capable, according to its makers, if not to Professor Lucasiewicz, of going 190 kilometres an hour -- paused twice more to permit the brakeman to throw and then reset by hand the CN/CP interchange switch. Well, well, well. It

would not take a genius and a bucket of money to cut an hour off that schedule! Only the next hour after that would get you into heavy thinking and expenditure.

But let us move to an even more problematical sector of passenger service. VIA as a whole understandably preoccupies federal transport bureaucrats. Its summary total execution is obviously not on politically for at least some years*; meanwhile, its deficits (unlike Amtrak's) continue to mount.

Could we, for a start, detach VIA from that vast cash sum, the transcontinental service? Politically, again, I doubt it -- at least for the near future. We all remember what descended upon Mr. Pepin's head when he cut the northern transcontinental service. Now that he must shortly shoot down the Crow -- certainly a more important matter for the economy at large -- he perhaps has some right to say, "Enough, already! Ca suffit, donc! Let some other martyr shoot the next albatross!"

Now, as a straight, hard-line economist I would of course feel compelled to recommend getting rid of the transcontinental service forthwith, providing substitute bus or self-propelled railcar service to any communities thereby left high and dry. But for yet another Canadian economist to beat his head against a brick wall here would not affect the practical outcome at all. It would be a banal and therefore an unamusing spectacle for you, and a least-preferred form of exercise for me. I'd rather be weight-lifting in a Toronto heat-wave, or something.

But let's be quite clear what multi-year continuance of the southern transcontinental service on much the present basis means. Not only does it mean that operating deficits on the service will continue to be a significant drain on the taxpayers, plus a major depressant on VIA's financial statement and thus on the morale of its executives and other employees, it also means that substantial capital spending must shortly be contemplated to replace equipment. The present equipment is showing its age, working its joints and pipes noisily at night, and so discouraging sleep and ticket sales. Substituting for it something like Amtrak's new bi-level stock will cost a pretty packet, given that we need perhaps eight or more train sets to maintain a full, end-to-end daily service.

Against that background, but within the political constraint, I would like to make a serious, second-best suggestion which I dare say some of you will find impossible to treat seriously. Here goes anyway. This service is not now -- nor can it, I think, ever be again -- a significant means of

---

* For confirmation of this, close observation is suggested of the next two partly-political leadership conventions at the federal level. My prediction is that while a great deal will be said about cutting the federal deficit in general, none but the most marginal candidates -- and perhaps not even they -- will say one clear word in favour of discontinuing VIA trains. Meanwhile, in the U.S., we note a very substantial, congressionally supported persistence of Amtrak against the express wishes of the Reagan administration when it took power.

moving large numbers of people for long distances across Canada. Apart from anything else, we need the track for freights, especially out west. Outside of some special-case communities, whose needs I have suggested could be met more cheaply in some other way, the service is essentially a luxury land-cruise, an expensive nostalgia-trip to yesterday, part of a complex but politically potent love-affair with history.

Stuck with this, as we apparently are for now, I suggest that we might have a chance of cutting the losses substantially by treating and marketing the service more for what it really is.

I suggest that we do an Orient-Express number on it.* Don't laugh! The revised, private-enterprise Orient Express between London and Venice appears to be hovering on the margin of profitability and certainly is not devouring money in the way that The Canadian is. I suggest that as the re-equipment deadline draws near, we first try out an alternate scenario involving perhaps two train sets on the Winnipeg-Vancouver leg only in the first instance -- two of seven weekly departures each way (I am a great believer in marketing things initially on the smallest scale consistent with getting a clear signal about whether the public -- and the voters, too, in this case -- will go for them).

I suggest that we comb sidings and work trains for all the surviving standard-steel equipment we can find, including notably some open-ended observation cars. These should then be thoroughly rehabilitated. Down below, they should be fitted with extremely up-to-date trucks, couplers, heating, electrical and air-conditioning systems. Above, however, they should be lovingly restored to resemble in every detail luxury CPR equipment of about the year 1929.

Remember that we are not talking about serious mass transportation here, now or in the future. Nor about blinding speeds, which the mountains bar anyway. Let us face all that. We are into a heritage tourist attraction like Louisbourg. That means gastronomy, as on the Orient Express. Special attention should be devoted on the dining car: cutlery, linen, the menu limited in range but worth one or even two stars from Michelin. As a concession to Canadian populism, there should be maybe three standard-fare coaches up ahead with reserved, reclining seats, and a constant, rolling snack bar, after the fashion of Japanese National Railways, for the rucksack and school-group trade. Since we've got a dining car anyway, the JNR box-lunches might as well be fresh.

Behind the rucksack section, however, all should be as aboard the old Imperial Limited, and that might indeed be an appropriately nostalgic name for the service.

---

* Algoma Central's popular excursions to the Agawa Canyon have certain elements of the Orient Express approach to them, notably insofar as they incorporate a realization that tourism (with a touch of nostalgia), and not transportation, is the real name of the game.

As with the Orient Express -- which, remember, makes money -- first class meals and accommodation on this run would be very pricey: enough to cover all variable costs, and then some. What we would be marketing here, very vigorously, would be hardly transportation at all, but rather a once-in-a-lifetime western tourist experience, unique in North America as to duration, completeness, and lengthy exposure to world-class scenery. Amtrak has nothing even close to this sort of package. God help us, we might even sometimes put a steam locomotive on for a short part of the trip -- though not, I think, as some rail buffs might crave, in the Kicking Horse Pass, where CP sometimes needed as many as three engines to get a passenger-train up the hill.

Well, think about it. It might lose us less money than what we are presently doing. It could hardly lose us much more. As a long outside chance, if we could involve in the operation a promotional genius of the same calibre as those who have made history into black bottom-line aboard revitalized sailing ships and cruise liners (note carefully how good, non-plastic food is always part of their packages), we might even break even and find ourselves looking at a first-best rather than a second-best solution.

But now let us move back into transportation and the higher-volume situation of the Windsor-Québec corridor. Here, partly on account of a serious lack of agreed data, there is much controversy and a remarkable range of opinion. Professor Lucasiewicz -- one keeps encountering him -- says, for example, that if the LRC locomotive runs at its full design speed, it pounds the track apart.* Others tell me that there is indeed a problem, partly occasioned by design modifications undertaken to meet traditional conservative standards in a prospective U.S. export market, but that the problem may be remediable.

More broadly, some impressively qualified people hold that the economics of any corridor rail is ultimately as much a no-hope situation as that of the present type of transcontinental service. Others assert that for a cool $1.5 billion in 1978 dollars we could have a profitable service, as technically advanced as the best French and Japanese examples, and that we should go straight to this and not mess about with wretched companies.**

Before taking up a more definite stance somewhere along this lengthy spectrum of opinion, I'd like to peruse a great many more numbers and other information. But the information I have seen already has generated in me some serious doubts about the extreme, $1.5 billion end of the spectrum -- doubts which I would like to share with you today. Even if we could safely assume that an economic corridor service is ultimately possible, I doubt that this paticular scenario would prove to be it. It could be a case of the technologically "best" turning out to be the enemy of the more Canada-appropriate "good".

---

* See J. Lucasiewicz, "Japan, France Can Do It: Why Can't Canada?", The Globe and Mail, March 21, 1983, p. 7.

** See J. Lucasiewicz, "Passenger Rail Policy: A $2-Billion Fiasco", Canadian Public Policy, VIII:3, Summer 1982, p. 377.

Mind you, I understand well enough the spirit of exasperation with the present service that encourages some people to want to wipe the slate clean and start again from square one. How nice it would be to have done with the whole, nineteenth-century business of only quasi-automatic couplers, steel spikes in wooden ties, people setting switches by hand in Smith Falls, endless negotiations and hassle with the big railways, an inability on Parliament's part to find out, on behalf of the ultimate shareholders, whether one Crown corporation is charging another Crown corporation a justifiable rental for trackage and other benefits, and pay-structures still keyed to the speed of Victorian freight trains! With so many strange, imperfectly costed things going on in the corridor, it is impossible at this point to make a proper division between the short-term-avoidable and the core deficit. How nice just to shove all this behind us, put in a whole new right-of-way and operating system, and run some serious trains like the French and Japanese!

Oh dear! How very cautious, Canadian, bureaucratic and uptight I'm going to sound at this point. As just mentioned, I'd like to look at a lot more of these numbers: cautious numbers, bold numbers, all kinds. Some of the numbers I'd most like to look at don't yet appear to be in the public domain. I'm not ready at this point to rule out that a corridor service sufficiently fast, reliable and cost-effective to sustain itself economically -- or, failing that, to stay predictably within a deficit-limit stipulated by Parliament -- might not at some stage be possible. But I doubt very much that if such a service appears, it will be close to an exact replica of Tokyo-Osaka or Paris-Lyon.

Why not? A first concern is population density. These two really super passenger railways that we know about today -- operating, apparently, at a profit though within unprofitable systems -- both have on one end of them a metropolitan capital city region containing over ten million people. Amtrak has a similar region in the middle of its Northeast Corridor. That is a lot of people. It is several orders of magnitude greater than the population densities that we are talking about in the Windsor-Québec, or even in just the Toronto-Montréal corridor.

It makes a big difference because those kinds of potential travel populations can justify a service frequency which in turn feeds back on the attractiveness of the service and so on total volume. Often the evening trains are particularly important. If you are thinking of becoming dependent on any kind of a train service -- such as the Lakeshore, Go-Train Commuter Service, which exemplifies this matter very well -- it is very reassuring to know that if your business affairs or your pleasures should keep you overtime, there is still another train to get you home. Population density -- great population density -- is the law of Moses and Prophets if you are going to run passenger-trains at a profit, or at least on a reasonable opportunity-cost basis, relative to what you might feel compelled to spend on alternative facilities if you killed the trains. We do not have the Japanese, French or Northeast-Corridor kinds of population densities and I believe that is an important fact and ought to condition all thinking about an improved corridor service.

I have mentioned an investment estimate of $1.5 billion for a complete 'new' high-tech, let's-start-over approach to corridor rail. I have an intuitive scepticism about all such estimates -- oh, I suppose, just out of age and experience, and knowing what a consistent pattern of cost overruns we typically get, especially when we are going to very new (for us) technologies. I'm particularly doubtful as to whether any of the cost estimates that have been done, have included enough for acquiring right-of-way (an extraordinarily difficult thing to estimate, let us admit). If we are going to have a whole new right-of-way, we must acquire it, according to some plans I have seen, to produce whole new entries into central Montréal and central Toronto. If in addition, we propose to continue making some of this service conveniently available to centres like Belleville, Brockville, Kingston, Cobourg, and Oshawa, we are, presumably looking at urban right-of-way acquisition there too -- if we are going to a whole new right-of-way.

For a start, urban right-of-way acquisition expensively destroys a great many existing buildings for which the owners must be compensated. Then there's the politics of it. Let us think back in very realistic fashion, remembering that we are still Canadians, with our characteristic little habits, upon the history of land acquisitions for transport purposes believed by some Canadians to be noisy. Consider the story of land acquisition at the time when we seemed to be judging, very sensibly in my view, that one of the first things to do to accommodate growing air traffic was to considerably enlarge Toronto International and Dorval Airports.* The politics and economics of land acquisition, based on the record of this sort of thing in Canada, should give us great pause, it seems to me.

Now, of course, one way you could cut down on land acquisition costs for a brand new corridor railroad, would be to run the thing up in the cedar swamps, well north of the 401 highway, on a brand new, non-urban right-of-way! The trouble with that is that it would essentially offer inconvenient-to-no-service to a number of intermediate points which have had train service for well over a century, are very attracted to it, and would make a lot of political noise if they were deprived of it. I think, in all realism, if you decided to strike north and steer around a lot of those places, you might very well end up providing a non-stop or three-stop service on the new line while being forced politically to maintain an appreciable local passenger service on the old line.

Which leads me back to an important point that I made earlier in this paper: that an existing right-of-way can be an extremely valuable asset. It is already there. You don't have to buy and clear it. Moreover, the abutting land users, over long periods of time, have gotten used to living with the noise and other environmental minuses that heavy transportation involves. Those who didn't want to live with them have long since decamped. Ergo you don't have great armies of protesters incensed at the idea of supertrains running just beyond their backyard fences.

---

* Future economic historians and public choice theorists may well come to marvel at the immense impact exerted on major Canadian transportation facilities (including, indirectly, rail facilities) by a relative handful of property owners in the western reaches of Montréal and Toronto.

It also seems to me that, just considered as a right-of-way -- I am not talking about the track and its quality -- the old Grand Trunk route from, say, Toronto to Montréal, (let's just consider that segment only), has an awful lot to be said for it. Most of the station locations on it are more or less convenient -- even Kingston's, now that the city has grown out towards its station to a considerable degree. And of course the accesses to the centres of the two big cities are not at all bad, although I am not sure that the Windsor station in-run to Montréal isn't more convenient than that sharp curve out of St. Henri to Central Station.*

What I am really getting to is that while I can certainly see some of the strengths in the case for separate track -- for separate tracks and separate operations of fast passenger-trains on this run -- I think that if we are building at all, we should give very serious thought to placing those new tracks, at least for large parts of the distance, on this excellent existing right-of-way. In other words, we would basically turn a two-track railroad into a four-track railroad.

This would make for further conveniences in our uncertain climate. If you have a derelict train -- and sometimes you do, let's face it -- it is awfully convenient to have other tracks and sidings nearby, over which to switch it fairly quickly out of the way and continue the service with your other train sets. I also doubt that when push comes to shove, any government of this country will really provide the money to put in place a whole new, dramatically-publicized railroad within a short time. All sorts of considerations come into this: overall deficits, and many others. For instance, if government is found ready to be spending that kind of money on rail passenger service between Toronto and Montréal, you and I know what kind of powerful, "me-too" representations are going to be heard from other regions.

If there is to be improvement (and this is a very big assumption that I'm working on here), it does seem to me that we ought to give very serious consideration to approaching track-upgrading in the corridor in a more incremental fashion. Let us start with the track that we have got, and above all with the right-of-way that we have got, and gradually add more high-speed track within that existing right-of-way or, in places, on a slight enlargement of it.

We realize, I trust, how many grade separations we are talking about along this route. Those, too, under this scenario, would be approached incrementally.** Thus, gradually, patiently, we would improve the speed -- and what is just as important, the reliability -- of the service, and see how

---

* Some might identify the best in-run of all as the CN Mount Royal tunnel -- which, however, is only single-track at present.

** A great general virtue of incremental approaches is, of course, that they afford so many more chances to react to new data and otherwise change one's mind. More specifically as to grade-separations, each time you grade-separate two passenger tracks in a four-track piece of corridor, you are also led to provide, at relatively little extra cost, a probably long-needed separation over the two freight tracks as well.

the public reacted and operating costs behaved. We might electrify it in due time -- perhaps at a time when CN might itself be growing interested in electrifying its freight operations along the route.

Now I do realize, believe me, some immense complications in all this -- above all, in the relationship with CN and CP, and with railway labour. But ardous and protracted negotiations, some perhaps extending into Parliament itself, still come an awful lot cheaper than 1 000 new grade-separations in one fell swoop!

I think that one would have to look at a substantial restructuring of VIA. The transcontinental service might well be detached and run on some other basis. I am inclined to think that a short, sharp, one-man royal commission, headed by a crusty old judge, might be a useful first step to take here. Out of this might come, for one thing, a clarification of the appropriate relationship between VIA and CN/CP in the corridor.

In respect of right-of-way occupancy and related matters, I doubt that a standard, property-rights-litigation approach to a new agreement would be appropriate. For one thing, over most of the distance, the railway in question is CN -- ultimately owned by the same shareholders as is VIA. Anyway, a far more important set of CN rights, I submit, are CN's rights on behalf of us all to do the best possible job of moving freight. Thus, as a sort of conceptual base-line from which to start figuring reasonable compensation for trackage rights and right-of-way rights, we might have it that CN has a right on behalf of the people of Canada to run its freight trains as efficiently and as profitably as if the passenger service were not there.

It also seems to me that you would certainly want VIA to have its own reasonable labour agreements with its own staff. What's reasonable? There's no fast answer to that. Let's imagine an engineers' contract being revealed to Parliament. If, under this contract, engineers responsible for fast passenger-trains turned out to have somewhat higher average earnings than those responsible for freight trains, little objection might be raised. Disclose, however, a continuing picture of 100 mph speeds and 100-mile "days" ... if a person were ruthlessly determined to kill corridor rail (and employment thereon) by any means whatsoever, encouraging that that sort of contract might in the end be one of the best.

Perhaps the royal commission might be of some help on the labour front also.

But let me pursue a little further this matter of the incremental approach. What might be our goal in terms of time elapsed for, say, the Toronto-Montréal run? In looking at such figures as are available in the public domain, I am struck by the fact that if you try to go from four and a half hours to three and a half hours, and then maybe to something more like two and a half hours, the marginal cost of that step from three and a half to two and a half hours may well be enormous. I really wonder, given the facts of airline transportation and related ground connections so far as we can project them, whether there will be any need to take that final step this century.

If proceeding in the incremental fashion that I have outlined, stopping to ask ourselves at appropriate intervals, "Hey look, is it worth it? -- are we getting the scale-economies, the better loads and the better nets that would justify a further step?" -- if, proceeding in this fashion, we reached the point of being able to do, say, Toronto-Montréal in three to three and a half hours reliably, on time, why, that might be good enough for some while ahead.

So the best French passenger trains would be considerably faster than ours? So what? They were in the twenties and thirties too. Theirs is a different country and transportation picture. Let national-prestige addicts reflect that more than most railway systems, ours was built primarily to haul heavy freight over medium and long distances, through tough geography and sparse population. This it still does on a large and indeed increasing scale, if at a performance level well back of the known state-of-the-art -- concrete ties, fully automatic couplings, and all that. But compare its technical performance with actual foreign performance, remembering that "over there", we still see plenty of buffers, screw-couplings and links, and a certain sense of self-respect returns.

CONCLUSION

You asked me to come and shoot some ideas at you, some even conceivably a trifle new, and that is what I have done. Nobody, I am sure, could possibly accuse this presentation of masquerading as a mature research report. While it is certainly research-influenced, the research in question is predominantly other peoples'.

The presentation has fallen into four main parts. In the first two, I discussed the importance of conceiving our passenger common-carrier system in multimodal, interconnecting terms, and urged a major upgrading of the status of the bus mode in our transport planning. About these two matters, I have been reading and thinking for some while, and have even written a little. They may well have been the best-ripened and most important parts of my message to you. If I were asked where, in the domain covered by this paper, policy actions and investment dollars might bring the biggest and promptest return in terms of more cost-effective transportation for Canadians, here is where I would put my finger. I didn't have time to slip it into the main text, but I think we could do well, to enlarge VIA's mandate so as to embrace a keen concern for modal interconnections and a fuller exploitation of the bus network. It is important for more of the public to actually experience really first-rate intercity bus service.

In part three, I ventured what some might regard as a fanciful suggestion regarding transcontinental rail service. I believe it should be checked out. In various places around the world today, "mobile heritage" has been turned into a viable tourist asset. Given the cleft stick we presently seem to be in, we should not omit to enquire carefully, into this possible way out.

Finally, in part four, I made some observations about rail service in the Windsor-Québec corridor. Noting a wide range of findings about this, many of which I would like to explore more thoroughly, I did not take a clear

yes-or-no stance, but expressed some strong misgivings -- given our circumstances -- about a strategy of investing soon and heavily in a wholly new facility on a new right-of-way. I suggested that, compared with this, a more incremental strategy, profiting from the many virtues of the existing right-of-way (as distinct from track), would offer important advantages, and might even in the end deliver a greatly improved, more useful and more used facility that we felt in the same sense we could afford.

WHY IS PROCEDURE IMPORTANT?

A Lawyer's View of The CTC General Rules

by

H.N. Janisch
Professor of Law
University of Toronto

WHY IS PROCEDURE IMPORTANT?
A Lawyer's View of
The CTC General Rules*

I. INTRODUCTION AND THESIS

For forms of government let fools contest;
Whate'er is best administered is best.

Alexander Pope, An Essay on Man

Let me start by assuring you that I do not intend in this paper to dwell on matters of procedural detail or to take you for a guided tour through the proposed new General Rules of the Canadian Transport Commission (CTC). What I wish to do is to talk more generally about the importance of procedure and to share with you my concern for the lack of an effective dialogue between administrators and lawyers on procedures appropriate for regulation. I should add, however, that I would be very pleased to focus on more specific matters in the discussion period to follow, but I think it would be well to start with some broader perspectives.

Boldly stated, my thesis is that today there is a wide and destructive gulf of incomprehension between administrators and lawyers and that much will have to be done to build bridges between our mutually dependent professions if there is to be improvement in the quality and acceptability of regulation.

I am by no means pessimistic about our ability to build bridges. Indeed, if all I saw was an unbridgeable chasm, I would not be here today! My optimism is based, in part, on my experience here at this Commission and my more recent work with the Ontario Public Commercial Vehicle Act Review Committee, and, in part, on my perception of changes in legal education and lawyers' values.

The vast majority of my time when I was at the CTC for the Law Reform Commission of Canada was spent, not with lawyers, but with staff in the various modal committees. I came away convinced that my lawyerly concern for fair procedures, if couched in non-legalistic terms, was largely shared by those invovled in actual decision-making. One example must suffice. In learning about the "file hearing process", the sophisticated written procedures employed by the Air Transport Committee, I became concerned about fairness should staff add new evidence which applicants or intervenors would not have an opportunity to meet. This problem would be particularly acute should the new evidence concern particular facts about an applicant and not just general industry facts. As we concluded in the Law Reform Commission Study:

---

* This paper was presented to the Canadian Transport Commission on May 27, 1983.

> The Committee staff, for example, may have received allegations against a particular applicant and wish to include them in its assessment and report. Such documents are not normally released for public scrutiny. However, fairness demands that the applicant have an opportunity to reply to the allegations. This is recognized by the Committee's procedures which provide that "where an allegation is made regarding the service provided by a particular carrier, the comments of that carrier are to be obtained." Our discussions with staff members revealed that they are sensitive to the need for fairness in such instances.(1)

What then of legal education and lawyers' values? Historically, lawyers have been hostile towards administrative agencies, tribunals and commissions and have rallied behind an extravagant version of the Rule of Law which insists that persons should only be affected by "ordinary" law as enforced in the "ordinary" courts. President Roosevelt, in his 1940 veto of legislation designed to cramp the style of the precocious New Deal agencies, captured well this jealous hostility:

> A large part of the legal profession has never reconciled itself to the existence of the administrative tribunal. Many of them prefer the stately ritual of the courts, in which lawyers play all the speaking parts, to the simple procedure of administrative hearings which a client can understand and even participate in. Many of the lawyers prefer that decisions be influenced by a shrewd play upon technical rules of evidence in which the lawyers are the only experts, although they always disagree. Many of the lawyers still prefer to distinguish precedent and to juggle leading cases rather than to get down to the merits of the efforts in which their clients are engaged. For years, such lawyers have led a persistent fight against the administrative tribunal.(2)

Somewhat ironically, this hostility proved largely counter-productive because although legal dogs barked, the activist state wagon rolled on largely unencumbered by legal values. It has only been in recent years that lawyers have made their peace with the inevitability of law other than good old common law and "courts" other than the traditional courts of law and have started to set about in a serious fashion colonizing the administrative process with legal values. Instead of a restrictive approach which seeks to limit government, the new approach embraces government and seeks a more positive role for law. As one perceptive commentator has put it: this approach "...affirms the responsibilities of government but at the same time extends the reach and relevance of legal criticism."(3)

Certainly at the law schools there is plenty of evidence of a move from a narrow doctrinal approach towards one which emphasizes

multidisciplinary breadth. Consider, for example, courses offered at my school such as "Public Policy Formation" taught by a political scientist, "Regulation" taught by a lawyer and an economist, "Social Science Methods of Legal Research" taught by a sociologist, and "Economic Analysis of Law" taught by a lawyer-economist. My own communications law courses are infused with economic, technological and political considerations. As well as offering an optional course in "Transportation Law" in the upper years, all first year students have to take a course in Public Law in which they are exposed to the complexities of economic regulation via an intensive look at the regulatory and political ramifications of the "temporary" takeover of Nordair by Air Canada, and the mysteries of policy making by ministerial press releases.(4)

All in all, I see the Neanderthal Rule of Law approach as much on the wane and a more constructive, positive attitude emerging. This is not to say, however, that lawyers, particularly those in private practice do not have a somewhat myopic view of the administrative process. Few lawyers have any real feel for the whole system of which any legal issue is but one facet. Lawyers see the administrative process through the eyes of individual clients. As Peter Woll, a political scientist, observed in his excellent text, American Bureaucracy: "Administrative lawyers are formally trained in how to prevent government from acting arbitrarily against private interests, rather than in how to make a government action more effective in the public interest."(5) This perception is also to be found in Marver Bernstein's classic study, Regulating Business by Independent Commission, where he notes that lawyers "...have been far more inventive in devising ways of protecting individual interests than in promoting the public interest without violating individual rights."(6) John Willis, a pioneer in the teaching of administrative law in Canada, has captured this basic attitudinal predisposition so critical to any servants in inimical style:

> Consider the normal lawyer's biases. Because he acts for individuals, he necessarily emphathizes with the individual. Because he is steeped in the common law, he views with alarm any departures from the eighteenth-century Constitution which he finds in the law reports. Because he lacks experience in the facts of governmental life, he has little interest in what actually happens there. Because he is familiar with law as a shield to be used in the defence of his clients, he overestimates the importance of legal safeguards and underestimates the importance of the, to him, fairminded civil servants, a vigilant press, and a 'watch that government' atmosphere in the general public. (7)

It is unlikely that this bias will ever entirely disappear. Indeed, that is how it should be for I do not see lawyers as the handmaiden apologists or facilitators of the interventionist state. Lawyers to my mind should retain their bias in favour of the individual although not as Willis suggests by way of an antiquated, outdated, and in the long run, as we have seen, ineffective view of government.

Ideally, what we need is less antagonism and more cooperation which stops well short of capitulation. As William Robinson put it over 50 years ago, what is now badly wanted in our governmental system is a cooperative effort between the legal mind and the administrative mind.(8) "What society needs," he added, "is the operation of the judicial spirit far more than an insistence on the mere outward features of formal courts."(9)

I would be most interested to hear from you as to how such a "cooperative effort" could be put into effect.

II. LAWYERS' COMMITMENT TO FAIR PROCEDURE

For lawyers, procedure is no matter of secondary importance. As Justice Frankfurter said, "The history of liberty has largely been the history of the observance of procedural safeguards."(10) Or as Justice Jackson observed, "Procedural fairness and regularity are of the indispensable essence of liberty. Severe substantive laws can be endured if they are fairly and impartially applied. Indeed, if put to the choice, one might well prefer to live under Soviet substantive law applied in good faith by our common law procedures than under our substantive law enforced by Soviet procedural practices.(11)

Thus, for the lawyer, how something is done is held to be just as important as what is done. Indeed, so single-minded is this faith in form that it is sometimes rightly suggested that lawyers have no interest in substance at all: "Let's give the man a fair trial and then take him out and hang him!" Or as Ogden Nash suggested, "Law is so in love with the law that it forgets common sense".

Be that as it may, what are the underlying justifications for this insistence on form? First, participation in decisions of government is justified by fundamental ethical and political beliefs about democracy, respect for individuals, and self-determination. Second, these procedures contribute to the making of better decisions through greater accuracy in fact-finding and comprehensive thinking about outcomes. Third, fair procedures can help make decisions acceptable to the individuals and groups that are affected through the process of participation itself. Fourth, procedures are a means of making agencies accountable. This is not limited to accountability to the courts; it can be accountability to the cabinet, the legislature or through less formal institutions such as newspaper and special interest groups.

Of course, procedures impose costs. The first is administrative expense, for example, the value of the time of the officials and participants. The second cost is delay. The third, is that participation may cause an agency to avoid making difficult decisions. For example, it may be frustrated by expense and delay or intimidated by the impact of participation and simply surrender and grant claimants benefits to which they are not, strictly speaking, entitled.(12)

There has been a massive growth in legal doctrine in recent years, by way of common law notions of "natural justice" and "fairness" as developed by the courts or by way of statutes and rules as interpreted, and often

amplified, by the courts.[13] However, there has been no systematic evaluation of the effectiveness or impact of enhanced procedural rights on the decicion-making process itself. There is much mythology here and little empirical verification apart from that of a highly impressionistic variety. Consider, for example, the following list of possible research topics randomly selected from a host of possible candidates:

1. Recently, the CTC has allowed some degree of participation (in rule-making) by way of public meetings.[14] What has been the actual impact, in practice, of this procedural innovation on the rules developed through this more open process?

2. Lawyers love oral hearings where, as President Roosevelt so shrewdly noted, "they play all the speaking parts". The common law position is that oral hearings are not always required in the interests of fairness.[15] What would the insights of psychology or sociology tell us about the importance of oral hearings?

3. In recent years, there has been some degree of systematic representation of the consumer interest before the CTC.[16] Mr. Benson once flattered the Consumers' Association of Canada by suggesting that intra-Canada charter air fares and discount fares had been introduced at least in part, in response to their representations.[17] Would this reassurance withstand critical scrutiny?

4. It has been suggested that in the interest of fairness, internal staff reports and assessments should be made public.[18] However, it is argued that this would greatly reduce the candour of communication between commissioners and staff, and lead to a destructive estrangement. Is this necessarily so?

5. It has sometimes been argued that commissioners should normally write their own decisions as this acts as a useful discipline and enhances the credibility of the hearing process.[19] What is the actual result of any division between hearing and decision writing?

6. It is widely presumed that greater participation leads to greater cost but so far little has been done to quantify these costs, or attribute them to the different parties involved in hearings.[20]

7. The capture theory suggests that extensive ex parte contacts between industry and their regulators lead to supine regulation.[21] On the other hand, it is argued that without such contacts, the regulator would not be well enough informed to do its job. What would an intense and systematic look reveal?

A forthright lawyer considering these seven matters would have to concede that he simply does not know what the impact is, or might be, of any particular procedural rule. This is not to say, however, that such candour should be met with derision because procedures may be justified not only on narrow empirically supported grounds but on broader and less easily quantified grounds of appearance. There is much truth in the famous remark that "Justice must not only be done but must be seen to be done." Consider the ex parte contact problem. Even if such contact were shown not to influence the thinking of the regulator, it might still be objectionable because it simply seems wrong that one party should speak to the decision maker without the other party being present.

This recognition of the symbolic value of procedures does not mean, I would suggest, that there is no need to evaluate what may simply be the foibles and self-serving myths of lawyers. This is particularly so because lawyers themselves are by no means in agreement even with respect to such central notions as cross-examination. Consider Lord Hewart's dogmatic assertion that, "Evidence not tested by cross-examination is nearly always misleading and practically valueless,"(22) with Mr. Justice Else-Mitchell's complaint of lawyers and their "...intractable and emotional faith in the technique of cross-examination as the ultimate touch-stone in most legal disputes..."(23)

In these circumstances, there surely must be room for cooperative interplay between legal and administrative minds which incorporates broader concerns of symbolism and appearance.

III. PROCEDURAL REFORMS IN A CONTEMPORARY CONTEXT

This is a particularly appropriate moment at which to reconsider procedures. We in Canada have chosen not to align ourselves with the American deregulatory movement and this continued commitment to regulation carries with it an obligation to upgrade the quality and acceptability of government regulation. All this has to be done at a time of growing public schizophrenia towards government. In this development, as Guy Benveniste has made clear in The Politics of Expertise, the public is largely to blame for promoting what has become known as "anemic democracy", a condition in which the people distrust their government, yet create a "demand overload" situation for it by expecting the government to tackle and cure all conceivable social ills. This places administrative experts in a no-win situation because their regulatory expertise is demanded, but the use of their apolitical expertise is considered illegitimate.(24) This deadly combination of distrust on the one hand and expectation on the other requires the development of a capacity for limited and meaningful public participation in the administrative process without destroying the obvious advantages of expertise. Thus, the search for appropriate procedures should not be seen as a peripheral concern but of central importance to the legitimacy of regulation itself.

This contemporary concern for process values is reinforced by a growing recognition that our regulatory grasp all too often exceeds our regulatory reach. All of us recognize that we simply do not have answers ready at hand for the myriad of regulatory issues which daily crowd in on us.

Indeed, an outspoken realist of the regulatory process of an "Emperor-has-no-clothes" variety might suggest that all there is to regulation is process. This is the view of my delightfully iconoclastic colleague Douglas Hartle, who has on occasion suggested that much vaunted notion "public interest" is, when all is said and done, merely the result arrived at after a full and free process has been gone through. In other words, there is really nothing to regulation but process! I find it particularly instructive that Charles Dalfen, at the time still Vice-Chairman, Telecommunications at the Canadian Radio-Television and Telecommunications Commission (CRTC), when exposed to this somewhat heretical view, did not dismiss it out of hand. Here is what he had to say:

> It seems to me that even though corporate executives, government officials or CRTC commissioners or any group may come out with decisions which are in substance brilliant, nevertheless, where there are divergent interests at stake, it's probably preferable to go through the process of a hearing and to go through the adversarial process even at the risk of coming up with a decision that is much less perfect than any of us would have conceived in the privacy of our own study or becomes almost more important in yielding the decision that the brilliance, the conciseness or the perfection of the decision itself.(25)

This recognition that process is almost more important than the decision itself is surely an idea worth thinking very seriously about. It may be the common ground on which concerned lawyers and administrators may meet.

As a teacher of administrative law, I am of course a professional procedural dilettante as well as a long standing hearing groupie. I have been struck in recent years by the extent of interest in procedural matters outside of the classroom. This certainly has been my experience in working with the Consumers' Association of Canada:

> I have always tried not to inflict my own fascination with the appropriate procedures to be adopted by regulatory agencies on others who might, quite rightly, consider my interest in the distinction between adjudicative and legislative facts, legislative and trial-type hearings, and the beauties of notice and comment procedures in rule making, as just so much legal pedantry when compared with the real gut issues of the consumer movement. Yet, I have found over the last several years that the Regulated Industries Policy Board, which is made up of a range of persons with quite diverse backgrounds, has been quick to grasp the critical inter-relationship between procedure and substantive outcome. Far from dismissing administrative law as mere window dressing, the Board's members have stated

> their concerns in a number of major briefs which made a significant and early contribution to today's regulatory reform movement. For a law teacher there can be nothing more exciting than to be taken seriously - especially by people not subject to the threat of a final, three hour examination![26]

More recently, I have found discussions at the Ontario Public Commercial Vehicle Act Review Committee[27] on the role of cabinet appeals and policy directions and the procedure appropriate to such appeals and policy making, to be most stimulating as it blends together my broader academic concerns with those of battle scarred (if not, indeed, shell shocked) veterans of many a regulatory campaign.[28] My only regret is that none of my students have been able to join in this type of interplay between the theoretical and the practical which for me should be the unique characteristic of a university based professional school such as a faculty of law.

Now all of this finally brings us close to the second half of my advertised topic - the proposed new CTC General Rules.[29]

IV. A GENERAL ACT VS. AGENCY CODES

There are basically two approaches which may be taken to the issue of procedures - either a general act can be passed by the legislature which lays down certain minimum procedures to be observed by all agencies, or individual agencies may take the initiative and draw up their own rules of procedure.

I deliberately exclude the courts from further consideration here as their intervention is highly sporadic, largely accidental and inherently incapable of providing the required comprehensive code. Procedures are far too important to be left to the absentee management of the courts. This is not to say that they can be ignored.[30] Indeed, in just a moment I am going to suggest that steps should be taken to forestall judicial intervention in a number of areas not yet included in the CTC General Rules. As well, as subordinate legislation, agency rules may be subject to scrutiny in the courts to ensure that they are compatible with general principles of fairness. However, I do not believe that an agency can afford to leave too much up to the courts as courts all too often fail to take into account the unique mandates of individual agencies. It is, after all, this ability to adapt to unusual tasks which is the particular strength of agencies as opposed to courts and it should be enhanced by tailoring and crafting home-grown rules of procedure so as to support and not obliterate the distinctive features of individual tribunals.

This ideal of maximum diversity within a framework of minimum procedural decencies has been well summed up by Victor Rosenblum, a former chairman of the Administrative Law Section of the American Bar Association:

> A central task of the administrative process is to enhance creativity, expertise, and responsiveness of regulatory agencies to changing problems and needs

> while preserving adherence to constitutional requirements of due process and common sense dictates of fairness. Agencies dominated by sheer legal formalism can be prevented from responding to the public interest, and the ensuing harm to the public from judicialization for judicialization's sake can be as great as when agencies operate through whimsy or claims of "divine right."! We've learned over the years that our system can be jeopardized equally by procedural arbitrariness or substantive stagnation; to do their jobs well, regulatory bodies must be able to tailor policies to conditions and circumstances of the times and to develop and administer such policies with due regard for constitutional and statutory traditions of fairness.(31)

In Ontario, following the McRuer Royal Commission in the late sixties,(32) a decision was made to go to the general act route. This has led to the need for exemptions from the act of some major agencies such as the Workmen's Compensation Board, and to excessive restrictions on the ability of other agencies to individualize their procedures. One example from the area of transport regulation demonstrates the problem. The Ontario Highway Transport Board would prefer to deal with many of its licence applications by way of exchanges of written information somewhat along the lines of the file hearings employed by the Air Transport Committee of the CTC to which I alluded earlier in these remarks.(33) However, the Statutory Powers Procedure Act appears to require oral hearings even when such hearings are inappropriate, expensive and a general nuisance to all concerned.

At the federal level, there is, fortunately, no general act, and agencies such as the CTC have both the opportunity and the obligation to develop their own rules of procedure. It was therefore with considerable interest that I participated in that process in late July 1981.

Time will only allow me a few rather general comments and I reiterate my offer to get particular in the discussion period.

First, the use of a public meeting format to discuss the proposed revision of the General Rules was in itself an excellent innovation much appreciated by all participants. The purpose of such informal rule-making procedures has been perceptively described by Bernard Schwartz as "...not to try a case but to enable the agency to educate itself."(34) Thus, the Commission was itself developing a procedure by which to develop procedures, just the type of dynamic, ongoing process which is called for! As Cardozo would have us remember, "Nothing is stable. Nothing absolute. All is fluid and changeable. There is an endless 'becoming'."(35)

Second, there was much in the proposals well deserving of support, particularly the new rules governing confidentiality,(36) interrogatories(37) and the revision and clearer identification of the procedures of the Review Committee.(38)

Third, apart from matters of detail, the only major shortcoming was the limited focus of the proposed rules. As stated in the Consumers' Association Submission:

> The Draft General Rules focus on the formal, adjudicative hearing process to the exclusion of almost everything else. Yet many of the most pressing problems in contemporary administrative law are concerned with informal and legislative process.... Because of its limited concern with anything but formal hearings, the Draft General Rules do not deal at all with:
>
> a) Less formal hearings
> b) Complaints
> c) Regulation making
> d) Staff studies and internal information
> e) Inquiries and investigations
> f) Ex parte contacts, and
> g) Role of Commission Counsel(39)

The danger as I see it is that much recent administrative law developed by the courts under the fairness banner, has been concerned with just such matters and if the Commission does not take the initiative here, it runs the risk of having procedures imposed by an outside body which is unlikely to be sensitive to its particular needs.

Fourth, there are extremely encouraging signs that drums long beaten by academic commentators and consumer advocates are now being beaten by representatives of industry. Take, for example, one of my own pet peeves -the inadequacy of reasons given for decisions.(40) Listen to the representative of the Air Transport Association of Canada.

> There are many board decisions or Commission decisions which come out which merely recite who said what and at the end of which say, we therefore find the following and have an operative order. I presume when you talk about reasons you mean something other than the mere recitation of what was said by various parties and then a conclusion. You intend to deal at some length as to the relevant findings of fact and policy and law.(41)

Or consider the same association's remarks about the "age-old complaint" about the concern many people have for the inaccessibility of staff reports;(42) or the discussion about access to examiners' reports;(43) or the recognition of the wide spectrum of commission activities ranging from the specific and adjudicative to the general and legislative.(44) All this was indeed sweet music to an old administrative law teacher's ears as once issues are recognized, resolution cannot be far behind.(45)

V. CONCLUSION

While I believe that there needs to be far more dialogue between lawyers and administrators (and I regard an occasion such as this, and the informal discussion to follow, as a valuable bridging exercise) I also believe, as I mentioned at the outset, that there are a number of opportunities being created for greater understanding. One in particular that I would commend to you as an example of just what needs to be done is the series of seminars for members of administrative tribunals jointly sponsored by the Law Reform Commission of Canada, the Privy Council Office and the Public Service Commission.(46) These provide a uniquely valuable opportunity for experienced lawyers and administrators to share their insights with newer members of agencies.

For all my lawyerly commitment to fair procedures and process values, I am by no means persuaded that the courts and the law have all the answers.(47) As to the courts, I would agree with Justice Frankfurter's comment that they are not charged with "...general guardianship against all potential mischief in the complicated tasks of government".(48) As to law, let me conclude by giving the last word to Grant Gilmore.

> Law reflects but in no sense determines the moral worth of a society. The values of a reasonably just society will reflect themselves in a reasonably just law. The better the society, the less law there will be. In Heaven, there will be no law and the lion will lie down with the lamb. The values of an unjust society will reflect themselves in an unjust law. The worse the society the more law there will be. In hell, there will be nothing but law and Due Process will be meticulously observed.(49)

REFERENCES

(1) H.N. Janisch, The Regulatory Process of the Canadian Transport Commission, Minister of Supply and Services Canada, Ottawa, 1978, p. 65. The general assessment of the file hearing process may be found in pp. 55-71.

(2) 86 Cong. Rec. 13,942-43(1940)
Roosevelt also warned of the danger of "great interests" effectively emasculating regulation by insistence on court-like procedure. "Great interests" which desire to escape regulation rightly see that if they can strike at the heart of modern reform by sterilizing the administrative tribunal which administers them, they will have effectively destroyed the reform itself. Ibid., 13 943.

(3) Philippe Nonet, Administrative Justice, Russell Sage Foundation, New York, 1969, p. 5.

(4) Our focus is on Decision of the Air Transport Committee in the Matter of the Proposed Acquisition ... of Nordair by Air Canada, Decision No. 5539, July 28, 1978; on the Cabinet decision not to vary the CTC decision not to disallow, P.C. 1978-3389, November 6, 1978; on the Ministerial Press Release of November 7, 1978, expressing the government's intention to return Nordair to the private sector within 12 months, and on the resultant policy chaos which includes the report of the Economic Council of Canada, Reforming Regulation 1981, at pp. 27-36, the Proposed Domestic Air Carrier Policy, Ministry of Transport, August 14, 1981 and the Domestic Air Carrier Policy, Ninth Report of the Standing Committee on Transport, House of Commons, First Session, Thirty-second Parliament, March 30, 1982.

(5) Peter Woll, American Bureaucracy, W.W. Norton, 2nd ed. New York, 1977, p. 77.

(6) Marver Bernstein, Regulating Business by Independent Commission, Princeton University Press, N.J., 1955, p. 16.

(7) John Wills, "The McRuer Report: Lawyer's Values and Civil Servants' Values", 18 Univ. Toronto Law Journal, 351, 1968, p. 353.

(8) William A. Robson, Justice and Administrative Law, Macmillan & Co., London, 1928, p. 282. He suggested that senior appointees to government agencies need a combination of legal training with special experience or training in the particular field in which jurisdiction is to be exercised. Ibid., p. 296.

(9) Ibid., p. 37.

(10) McNabb v. United States, 318 U.S. 332 at 347, 1943.

(11) Shaughnessy v. United States, ex rel. Mezei, 345 U.S. 206 at 224, 1953.

(12) These justifications and costs are drawn from Evans, Janisch, Mullan & Risk, Administrative Law, Cases Text and Materials, Emond-Montgomery Ltd., Toronto, 1980, pp. 31-2.

(13) Some of these developements are chronicled in Ibid., pp. 33-334.

(14) See, for example, Air Transport Committee, Invitation to Comment on a Discussion Paper Relating to Air Travel Now Offered under the Domestic ABC Charter Regulations, Canada Gazette Pt. I, Nov. 29, 1980.

(15) Hoffman - La Roche v. Delmar Chemicals, (1965) SCR 575.

(16) See Annual Reports of the Regulated Industries Program, Consumers' Association of Canada, 1976 - 1982.

(17) Hon. E.J. Benson, "Regulation/Deregulation in Airline Transportation: Social Responsibility and Consumerism", 33rd Annual Meeting of the Consumers' Association of Canada, Hamilton, June 18, 1980.

(18) As Bernard Schwartz has put it: "The great fear of those whose cases are decided by agencies is that the decision will actually be based upon materials of which they know nothing submitted by anonymous officials.... If they could see all the agency materials considered - even those characterized as mere staff memoranda - their principal grievance would be gone." Administrative Law, Little, Brown & Co., Boston, 1976 at p. 404. Schwartz, like Woll (reference (5)) and Bernstein (reference (6)) has also commented on the limited role played by lawyers in the actual processes of administration: "The lawyer tends to concern himself, as it were, with only the outer periphery of administration, i.e., with only those cases that flower into formal controversy.... His picture of the administrative process is of necessity a limited and even a distorted one, for he normally shuts his eyes to what constitutes the great proportion of the normal work of administration." Ibid., p. 28.

(19) A classic statement of concern is to be found in James M. Landis, The Administrative Process, Yale University Press, New Haven, 1938, p. 106. "Any judge can testify to the experience of working on opinions that won't write, with the result that his conclusions are changed because of his inability to state to his satisfaction the reasons on which they depend. Delegation of opinion writing has the danger of forcing a cavalier treatment of a record in order to support a conclusion reached only upon a superficial examination of that record. General impressions rather than that tightness that derives from the articulation of reasons may thus govern the trend of administrative adjudication."
However, as K.C. Davis has pointed out, there are practical limits to the extent to which commissioners should be obliged to write their own decision. "The objection to the separation of decision from opinion writing may be unanswerable except in terms of inevitability. No one has yet conceived of a system which will dispose of the quantity of adjudication, without an undue diversity of results, and will at the same time permit the deciding officers to write their own opinions."

Administrative Law Text, 3rd ed. West Publishing Co., St. Paul, Minn., 1972, p. 239.

A particularly useful analysis of this issue in a contemporary Canadian context is to be found in a study prepared for the Law Reform Commission of Canada, C.C. Johnston, The Canadian Radio-Television and Telecommunications Commission: A Study of Administrative Procedure in the CRTC, Minister of Supply and Services Canada, Ottawa, 1980, at pp. 74-77. Chris Johnston is a former General Counsel at the CRTC who drew on his extensive experience at the Commission in making his recommendations. He was particularly concerned with the practice adopted in respect of broadcast licensing:

> The incompleteness of the process in broadcasting matters means that decisions are sometimes taken without carefully thought-out reasons. As a result, staff members assigned to write the decisions have to flesh out the reasons provided. While all members of the Executive Committee have an opportunity to examine and request changes in decisions before they are released, and so can adopt or reject the reasons stated, it may be that placing the prime responsibility on staff members to write the decisions in this matter, required of them too much initiative in finding a supporting rationale. To the extent staff members do this, they become decision-makers, a function which should, of course, be exclusively that of the Commissioners.
>
> Accordingly, it would seem highly desirable for the Commissioners hearing applications to not only decide them but, where possible, to write the decisions as well. If this were done routinely, the chances would be greater that all relevant factors had been considered and weighed. The discipline of having to write decisions would of itself force Commissioners to consider very carefully all the facts and arguments presented to them on a given application and thus help to ensure a more searching approach to decision-making.

Consider as well the following frank advice from A.O. Soloman, Chairman of the Canadian Pension Commission:

> A number of Agencies have staffs which do a considerable amount of preparatory work and who may make recommendations to you, which you can confirm or deny. A common criticism is that the staffs make the decisions and that the Board members are merely rubber stamps for the purpose of legality. Don't fall into that trap. The responsibility for the decision is yours. Even with their recommendations you must check and research and make the decisions. They help you by setting up the case and the information available, by pointing out the legislative factors and policy and interpretations -- but the decision is yours. Certain members of the staff will no doubt in time take certain positions which will almost be cast in concrete.

> Watch for these. Don't let yourselves be anything but independent.

Speakers' Remarks, Seminar for Members of Federal Administrative Tribunals, Law Reform Commission of Canada, Ottawa, 1978, p. 51.

(20) For a general discussion of this enhanced participation see, for example, H.N. Janisch, "Administrative Tribunals in the 80's: Rights of Access by Groups and Individuals" (1981), Windsor Yerb. Access Justice, pp. 303-326.

(21) The move towards the capture theory has been well summarized by Stephen Breyer in his highly stimulating, Regulation and Its Reform, Harvard University Press, Cambridge, Mass., 1982, p. 10.

> The most persuasive general theory of regulation, popular among economists and political scientists until the late 1950's, held that regulation grew out of a need for a regulatory program to secure the "public interest" and that regulators sought, to the best of their ability, to secure the public interest as defined in their enabling statutes. This view has been discredited by historians and by economists, who have argued that many forms of regulation, such as trucking or airline regulation, injure the general public. Historians have shown that railroad regulation was brought about not by the general public seeking governmental protection from industry, but rather by the very industry to be regulated. The reaction against this view led some academics to embrace one or another version of the "capture" theory, for they see transportation regulation (as well as much occupational licensing) as designed primarily to protect those in the industry from competition.

(22) Lord Hewart, The New Despotism, E. Benn Ltd., London, 1929, p. 47.

(23) Hon. Mr. Justice R. Else-Mitchell, "The Place of the Administrative Tribunal in 1965", Papers of the Commonwealth and Empire Law Conference, 1965, pp. 65-74.

(24) Guy Benveniste, The Politics of Expertise 2nd ed., Boyd and Fraser Publishing, San Francisco, 1977, pp. 228-239.

(25) Charles Dalfen, "The Responsibility of Regulators" in Telecommunications and Regulation" Proceedings of the Sixth Annual Meeting, Canadian Telecommunications Carriers Association, 1977, p. 23.

(26) "Rights of Access", reference 20, p. 306.

(27) The PCV Review Committee was established in June, 1981 "...to advise the Minister of Transportation and Communications on the principles should form the foundation of new legislation which will regulate the trucking industry in Ontario over the next two or three decades." An interim report, Discussion Paper on Responsible Trucking was issued in

November, 1982 and a final report, Responsible Trucking: New Directions will be released in July 1983.

(28) For my views see H.N. Janisch, "Policy Making in Regulation: Towards a New Definition of the Status of Independent Regulatory Agencies in Canada", 79 Osgoode Hall L.J. (1979), pp. 46-106.

(29) Canadian Transport Commission, Draft General Rules of the Canadian Transport Commission, Ottawa/Hull, June 1, 1981.

(30) In reality what is needed is a positive interplay between administrative agencies and the courts as there is no way in which comprehensive procedures can be imposed and supervised through the litigation process. This dynamic has been recognized for many years. As Lord Hewart put it, "Nobody outside Bedlam supposes that the reason why Courts of Law exist in a civilized community is that the founders of the State have believed happiness to consist in the greatest possible amount of litigation among the greatest possible number of citizens. The real triumph of Courts of Law is when the universal knowledge of their existence, and universal faith in their justice, reduce to a minimum the number of those who are willing so to behave as to expose themselves to their jurisdiction." See reference (22), p. 160.

(31) Victor Rosenblum, "Turn on the 'Fasten Seatbelts' Sign: Turbulence Ahead at the CAB? 30," Admin. Law Rev. (Summer 1978) p.v.

(32) Royal Commission Inquiry into Civil Rights, Queen's Printer, Toronto, 1968. For a trenchant criticism of the basic philosophy of the report see John Willis, "The McRuer Report: Lawyers' Values and Civil Servants' Values", reference (7).

(33) As indicated to the author by Bruce Alexander, former chairman of the Ontario Highway Transport Board.

(34) Schwartz, see reference (28), p. 163.

(35) Benjamin N. Cardoza, The Nature of Judicial Process, Yale University Press, New Haven, 1921, p. 28.

(36) Draft Rules, see reference (29), ss. 130-32.

(37) Ibid., ss. 47-8.

(38) Ibid., ss. 114-127.

(39) Consumers' Association of Canada, Submission with respect to Draft General Rules of Canadian Transport Commission, July, 1981, p. 11.

(40) As expressed with respect to the Air Transport Committee's (ATC) file hearing process, for example, in The Regulatory Process of the Canadian Transport Commission, above reference (1), pp. 62-4. For a response see J.D. Gibberd, G. Hariton and P. Wesley, An Analysis of

Air Transport Committee Decisions 1973-1978, Economic and Social Research Directorate, Research Branch, Canadian Transport Commission, 1979.

(41) Canadian Transport Commission, In the Matter of a Proposed Revision of the General Rules of the Canadian Transport Commission, Transcript of Proceedings, Vol. II, p. 294 (July 28, 1981).

(42) Ibid., Vol. III, p. 393, (July 29, 1981) And see Commissioner Grey's response, pp. 440-47.

(43) Ibid., Vol.I, pp. 127-139 (July 27, 1981).

(44) Ibid., Vol. I, pp. 119-123, 146-156. (July 26, 1981).

(45) Consider, as well, the support for greater use of single commissioners or examiners so as to ration commission time for major issues as expressed before the Commission by J.R. Hamilton, a very experienced lawyer. Ibid., Vol. I pp. 123-125 (July 27, 1981).

(46) The Law Reform Commission of Canada has published the proceedings of three of these sessions: Speakers' Remarks, Seminar for Members of Federal Administrative Tribunals, April 5-7, 1978; Seminar for Members of Federal Administrative Tribunals, March 19-22, 1979; Speakers' Remarks and Excerpts from Discussion Period, Seminar for Members of Administrative Tribunals, March 10-12, 1980.

(47) As Gabriele Ganz succinctly put it: "The greatest disservice that lawyers can render administrative law is to mould the administrative process in their own image." Administrative Procedures, London, Sweet and Maxwell, 1974, p. 1.

(48) Federal Communications Commission v. Pottsville Broadcasting 309 U.S. 134 at 146 (1940). Or as Justice Stone put it, "Courts are not the only agency of government that must be assumed to have capacity to govern." United States v. Butler, 197 U.S. 1 at 87 (1936).

(49) Grant Gilmore, The Ages of American Law, Yale University Press, New Haven, 1977, pp. 110-111.

RISK ASSESSMENT FOR THE TRANSPORT OF HAZARDOUS COMMODITIES

by

Ian Burton

Director of the Institute
for Environmental Studies
University of Toronto

RISK ASSESSMENT FOR THE TRANSPORT OF HAZARDOUS COMMODITIES*

The regulatory agencies in the transport field need to take the business of risk much more seriously. This is probably true for all types of risk, but it is certainly true for the transport of dangerous goods. By the expression "take it more seriously" I mean to suggest three things. First, more research and more enquiry is needed into all aspects of risk so that experts, the regulatory bodies and the public may have a better appreciation of the problems of risk and public safety and that the level of public debate may be raised. Second, more professional staff are needed to carry out and supervise such work because present levels of professional manpower are insufficient. Third, the work not only needs to be done but should also be seen to be done, and hence better communication, information dissemination and public relations are required to tell people how the regulatory agencies are fulfilling their mandate with respect to risk.

There will be those who argue that the transport industry in Canada is already an extremely safe business comparatively speaking and that this policy prescription for spending more dollars on research and the regulation of risk is unnecessary and wasteful of public resources. The industry is already over-regulated it is argued, and now is not the time to propose further regulations. In the strict economic sense of costs and benefits they may well be right. More is at stake, however, than economic efficiency. Rightly or wrongly, people are concerned about the safety of transporting dangerous commodities. They seek reassurance and evidence that government is doing its job to see that the public is adequately protected. Where there is any evidence to suggest that this may not be the case then not only do people become alarmed, but they begin to lose trust in government--not just the elected government of the day--but the whole apparatus of government, especially the responsible regulatory agencies.

Like it or not, the transport industry in Canada must now defend itself, and the regulatory agencies must be able to show that they are doing a responsible job, even if this entails more research and more attention than might be considered necessary or desirable.

This paper starts with a general discussion about risk and risk assessment and then goes on to a case study of the transport of dangerous commodities through the Toronto Census Metropolitan Area, as an example of how problems arise and of the available approaches to their analysis.

The Preoccupation with Risk

In recent years, risks have become a major public preoccupation. This is especially the case in the United States, where it probably all started. Now the concern is widely shared in Canada, the countries of Western Europe, and Japan, and to some extent in the rest of the world.

---

* This paper was presented to the Canadian Transport Commission on June 3, 1983.

Public concern about risk and safety has been most evident in relation to the nuclear industry. It also may be seen in concerns about contamination of water supplies, air passenger safety, food additives, the transport and disposal of radioactive wastes and toxic substances, and in the concern about the risks associated with technical innovations such as microwave ovens, urea-formaldyhyde foam insulation, video display terminals and so on. The list seems almost endless.

One might be stimulated to ask, "Does this mean that life is getting more risky?" The answer is clearly in the negative. No, life is not getting more risky. Certainly, if you take life expectation as an overall aggregate measure of risk, it is clear that expectation of life in Canada, and most of the rest of the world for that matter, is going up. This means that the risk of death from all causes, as measured in terms of probability in a given time period is going down. The total spectrum of risks may be going up--that is to say, more risks are publicly identified now than previously, but each new risk adds only slightly to the total riskiness of life, and other factors are operating to reduce aggregate risks by a greater amount.

Longer life for the national population must mean on average a safer life. The most highly developed nations where modern technological risks are most evident also enjoy higher expectations of life. This is because economic development creates wealth and the wealth may be used to improve standards of medical care, nutrition, housing and so on. Whether you look at the differences between the richer and poorer regions and peoples of Canada, or globally at the differences between rich and poor nations, the message is the same--richer means safer.

How is it then that the safest of all peoples--the educated middle classes of the western industrial nations are now in a frame of mind where so many people are seeking more reassurance about adequate protection from risks? This is a complex question and only hints of some answers can be suggested here. First, there is a "progressive unveiling of problems" at work. When one set of problems is solved, people turn up the next one to worry about. When problems of basic needs and security are solved (or as close to being solved as they ever can be) people's attention naturally turns to other possible threats hitherto less visible or of less concern.

Second, there is no doubt that there are new risks. More dangerous commodities are now being produced and transported in greater quantities than ever before, and some of these commodities are new and highly toxic. Fear is generated as always by the new and the strange and the poorly understood.

Third, there is an enhanced capability for the identification and detection of risks, some of which may have existed before and others not. Suspected carcinogens may be detected in water, or food at levels of parts per billion. One part per billion is the equivalent of one second in just under 32 years (actually 31 years, 8 months and 15 days.)

There is no evidence that carcinogens or substances that are toxic in other ways, do actually cause damage when present in extremely small quantities. Nor is there evidence that they do not cause damage.

A situation of complete uncertainty exists. The search for toxic risks has the character of medieval witch-hunting; the more carcinogens are sought the more are found. The more that are found the more the pressure to go on looking. Innocence cannot be proved and so a self-reinforcing process is created. People have not discovered that the chemicalization of the environment is pervasive. So the possibility of harm has been created by human action although very little can be said about the probability of damage. This very inability on the part of science to speak in an authoritative way feeds the general state of nervousness that seems to exist. It quickly extends to any aspect or kind of risk that is brought fortuitously to public attention.

The Mississauga train derailment, chlorine release and subsequent evacuation in November 1979 performed such a fortuitous trigger function for the transport of dangerous goods by rail. Now every time a train accident is reported, even a small one, the media and a certain element of the public are reinforced in their concern for the risks of transporting dangerous commodities by rail.

Perhaps there are more fundamental causes underlying the public preoccupation with risk. The general state of insecurity created by nuclear weapons, and the possibility of nuclear holocaust is undoubtedly a cause for deep-seated anxiety. The social preoccupation with other risks may be a psychological process of transfer in which concerns in one domain act as a surrogate for less focussed and less easily expressed concerns. Fear and insecurity are undoubtedly stronger among those who have most to lose.

Whatever the underlying causes, the symptoms are everywhere to be seen. There is an obvious need to come to terms with our society's preoccupation with risk. It has already been suggested that the regulatory agencies in the transport field need to take risk more seriously, and to allocate more funds and professional manpower to this area. Many other organized groups are saying the same thing to themselves. The public purse is not bottomless, however, and the government agencies have a responsibility to propose expenditures within reasonable limits. We have a limited amount of money to spend on protection against all risks, whether realistically appraised or more exaggerated. So there is an evident need to introduce some enhanced element of rationality in the decision process that deals with public safety and the allocation of funds for this purpose. Failure to do this, (and there are signs that we are failing) will lead us into the error of allocating large sums of public money to protect people from small risks, while at the same time neglecting risks that are much larger in terms of their potential for harm.

There is an effort underway to generate a new discipline or a new trans-disciplinary approach to the way we deal with risks, and a number of volumes have recently appeared which describe this effort. (See, for example, Whyte and Burton, 1980, as well as a new journal entitled, Risk Analysis.)

From this and other literature a structure of the field is emerging, and may be briefly described.

The Structure of Risk Assessment

The simple diagram in Figure 1 suggests that there are three components in risk assessment--identification, estimation and evaluation. The term risk analysis tends to be reserved for the more scientific or intendedly objective aspects involved in risk measurement or estimation. The term risk assessment extends beyond the strictly scientific, quantitative and technical, into the domain of social science and of political judgement. Another way of looking at the structure of risk assessment is shown in Figure 2. Here the field is divided into the tasks of 1) measuring and estimating risks, and 2) judging safety by evaluating the acceptability of risks. A variety of methods in use and policy criteria are listed, and are elaborated at length in the literature. (See, for example, Kates, 1978.)

One further comment about risk assessment is in order before coming to the railway case study. The scientific and intellectual endeavor to develop the field on an intentionally rational basis inevitably comes into conflict with value-based public perceptions of risk. When it can be shown that the probability of a risk event is very small, the public does not necessarily accept the scientific finding and adjusts their perception of the risk accordingly.

The underlying scientific model of risk is that a risk is a function of the probability of an event times its consequences. When a probability is multiplied by a consequence (or a set of consequences) this yields an expected value of loss, usually on an annual basis. No matter how catastrophic the consequences of an event may be, it can be reduced to a very low risk if the probability of the initiating event is small enough. Thus, a one in a million event (Pr = 10^{-6} per annum) that may well result in a million fatalities, still has an expected value of only one death per year. In a rational economic model there is no justification for spending enormous sums of money to prevent one death per year. This analytical approach does not persuade those at risk once they know that a catastrophic event is possible in which many people may be killed.

This and other differences in view or value orientation underlie much of the conflict about the risk of transporting dangerous goods by rail in Canada and elsewhere. Generally, the probability of major accidents causing a large number of fatalities is very low. The possibility of such catastrophies does exist however, and it is this possibility rather than low probabilities which is the cause for public alarm.

The Mississauga Derailment

The derailment of November 1979 in Mississauga was accompanied by propane explosions and the rupture of a chlorine tank car. Fear of a massive release of chlorine gas led to the evacuation of 225 000 people for up to six days. (Burton, Whyte and Victor, 1981.)

The public enquiry into the accident (Grange, 1981) led to a number of recommendations to increase the safety of railway transport of dangerous commodities by more strigent operating regulations, (e.g., slower speeds),

Figure 1

BASIC STRUCTURE OF RISK ASSESSMENT

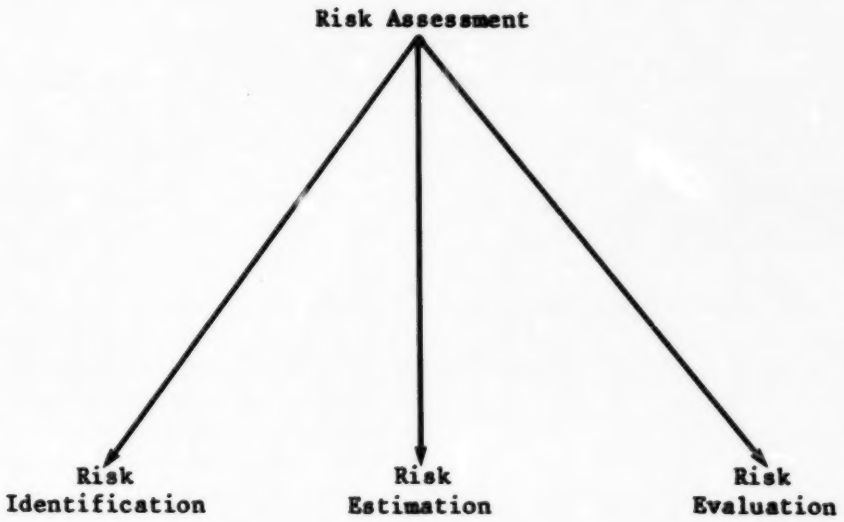


Figure 2

METHODS AND CRITERIA IN RISK ASSESSMENT

A STRUCTURE FOR RISK ASSESSMENT

MEASURING AND ESTIMATING RISK

Modelling	Objectives
event-tree and fault-tree analysis	Risk avoidance
dose-response relationships	Balanced risk
occupational analogues	Benefit risk
spatial analogues	Other objectives
Monitoring	
Experiments and Retrospective Studies	
accident analysis	

JUDGING SAFETY; EVALUATING ACCEPTABILITY OF RISKS

Public Policy Criteria	Means
Detection of any risk	Voluntary Consensus
Non-detection of adverse effect	Revealed Preference
Best practicable means (reasonableness)	Market mechanism
Best available means	Referenda, public opinion polls, media interest
Relation to occupational experience	Court judgements
Relation to 'natural' or background level	Standards
Relation to overall risk level	
Relation to other jurisdiction's acceptance, including international transfers	
Degree of public concern	

Source: Ian Burton, "Environmental Risk Assessment and Public Policy" pp. 149-56 in A.W. Rasporich, (ed.), The Social Sciences and Public Policy in Canada. Calgary: Faculty of Social Sciences, University of Calgary, 1979.

more detection (e.g., hot box detectors), and more monitoring and surveillance, (e.g., gateway inspections) and by the more rapid adoption of improved models of rolling stock.

These changes, however, did little to reassure the most concerned and activist members of the public, especially a new organization called M-Trac (Metropolitan Toronto Action Committee for Rail Safety), which has come into existence as a result of the Mississauga derailment and evacuation. The adoption by the Railway Transport Committee of some of the recommendations of the Grange Report merely served to confirm the existence of a "witch" and enabled the M-Trac organization to claim that the safety improvements were insufficient. After all, no improvement in safety could ever completely eliminate the possibility of a catastrophic accident.

This situation led to a further study (Burton and Post, 1983) in an attempt to examine the degree of risk and to suggest what further, if anything, might be done.

There are two standard approaches to the analysis of such risks. One can model the process and construct a hypothetical event-tree or fault-tree and one can rely on historical data--accident records. The study followed both approaches.

Risk Modelling

Modelling the risk process is an extremely time-consuming and expensive task. It was quickly realized that modelling would have to be on a commodity by commodity basis. Two examples of model studies were used from United States experiences--for propane and chlorine. (Pacific Northwest Laboratories, 1980A, 1980B). These produced risk spectrum diagrams (Figures 3 and 4) and permitted the calculation of the expected number of fatalities in any particular future year from the transportation of propane and chlorine over the entire U.S. rail network. The expected number of fatalities from the transport of chlorine was calculated at 9.4 in the year 1985 increasing slightly after that as the volume of shipments increased. A similar calculation for propane yields 15 fatalities in 1985.

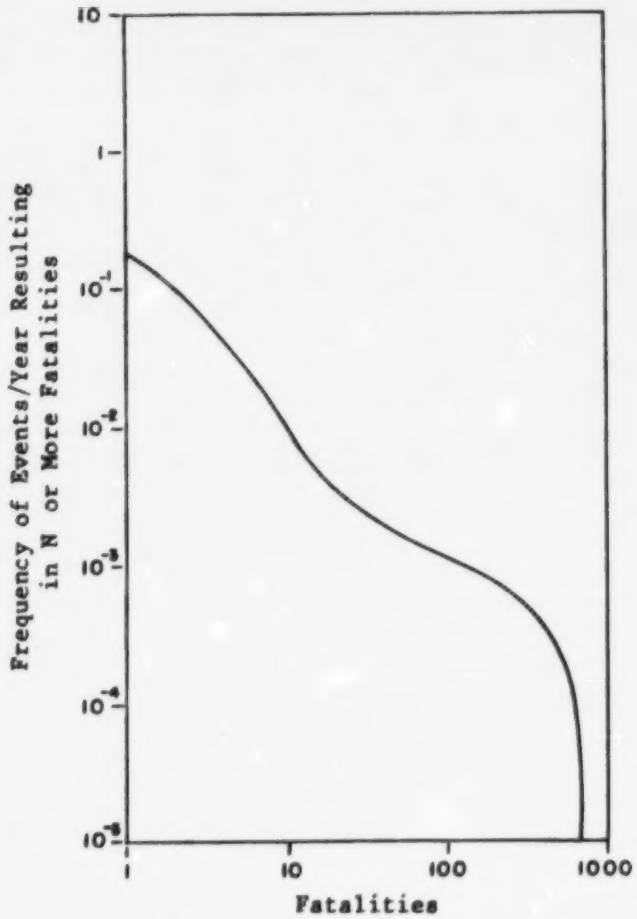
Clearly, if the results of such modelling exercises are accepted as valid, then the risk of being killed in a railway chlorine or propane accident is very low. In fact for the United States, it turns out to be 1 in 22 300 000 for the U.S. population compared with a risk of 1 in 33 000 000 of a person on the ground being killed by a crashing aircraft, and 1 in 1 300 000 of being killed by lightening.

These models do not, however, take into consideration the possibility of a catastrophic accident of very low probability. It is simply not worth pushing the analysis into the calculation of low order probabilities because they make no difference to the results.

Nevertheless risk modelling is clearly a useful component of the art of risk analysis. However, it does not and cannot resolve all the issues.

Figure 3

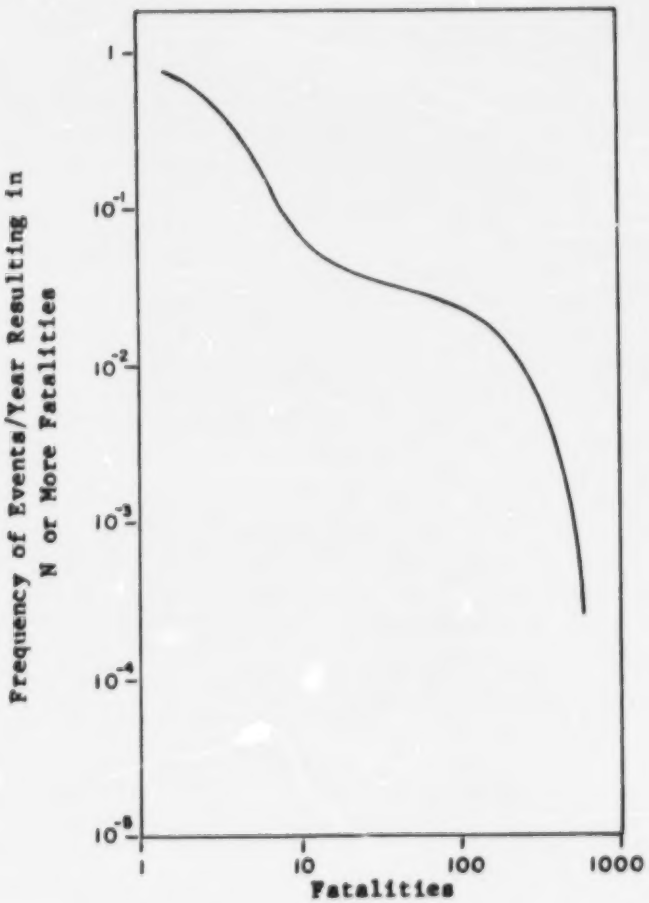
RISK SPECTRUM FOR PROPANE
SHIPMENTS BY RAIL TANK CAR
IN 1985 (U.S.)



Source: Pacific Northwest Laboratory 1980

Figure 4

RISK SPECTRUM FOR CHLORINE
SHIPMENTS BY RAIL IN 1985 (U.S.)



Source: Pacific Northwest Laboratory 1980

The Historical Record

A second approach is to examine the historical accident record (see Tables 1 and 2). Taking national accident statistics for Canada, we calculated that the expected number of accidents with dangerous product release on an annual basis is approximately 0.1 or 0.2. This means that at 1981 rates, an accident with dangerous product release can be expected to occur in the Toronto Census Metropolitan Area an average of once in five to ten years (Table 3). This estimate is obtained by dividing the total number of accidents resulting in release of dangerous commodities by the total length of track in Canada and multiplying by the length of track in the Toronto CMA.

Most accidents resulting in the release of dangerous commodities do not cause fatalities. The historical record therefore confirms the general impression gained from risk modelling--that the probability of accidents that cause fatalities is very low in any one place.

Relative Risk

The risk modelling approach and the historical record approach both show that the chance of an accident involving the release of dangerous goods in Toronto is low and that when an accident does occur it is not likely to cause many fatalities. This is an operation which many people would accept as "reasonably safe". The public concern following Mississauga has not yet died down, or been laid to rest apparently because of the possibility of a catastrophic accident.

To respond to this situation, a third approach has been developed, called the "relative risk approach". The new question is, "where are the risks greatest"? Without attempting any further refinement of the calculations of actual risk, it was assumed that there is interest in further risk reduction--even risk elimination--and the study set out to find out where the apprehended catastrophic accident might be more likely to occur, and what its consequences might be.

The flow of dangerous commodities over the rail network of the Toronto Census Metropolitan Area was sampled for a six-month period, January - June 1982 and is shown in Figures 5 and 6. These volumes of flow were then multiplied by the density of residential population along a series of rail "corridors". The idea behind this calculation was that the probability of an accident can be taken as proportional to the volume of dangerous goods being transported, and the severity of the consequences can be taken as proportional to the density of the population in the vicinity of the track. For this purpose an "inner zone" of 0.5 km and an "outer zone" of 2.0 km were specified, each centred upon the track.

The calculations yielded a relative risk index. The distribution of index values for the 29 corridors (inner zone) is shown in Figure 7. The corridors are shown by index value in Figure 8. From these two figures, it is evident that the North Toronto subdivision and part of the adjoining Galt subdivision (both of CP Rail) have by far the highest relative risk index.

Table 1

NATIONAL SUMMARY OF RAILWAY ACCIDENTS
1974 - 1981

	1974	1975	1976	1977	1978	1979	1980	1981
Number of Accidents	5 306	5 073	4 703	4 284	4 578	4 591	4 316	4 347
Casualties								
i) Passengers								
killed	1	-	-	1	-	-	-	1
injured	813	484	523	324	420	400	334	460
ii) Employees								
killed	24	23	8	7	9	10	10	8
injured	2 855	2 764	2 940	2 754	2 909	3 358	3 137	3 141
iii) Others								
killed	236	164	173	134	143	141	179	143
injured	681	627	590	403	437	453	428	404
TOTAL								
killed	261	187	182	141	152	151	191	152
injured	4 439	3 875	4 053	3 481	3 766	4 211	3 899	4 005
Classification Groups								
Collisions	73	82	64	63	81	66	97	115
Derailments	427	358	332	320	300	350	303	350
Crossing Accidents	1 074	982	923	877	871	937	826	763
Track Motor Accidents	60	50	39	55	55	48	60	55
Fires	492	534	63*	37*	11*	17*	13*	46*
Train Service	79	42	84	52	51	47	32	27
Personal Injuries	2 990	2 941	3 148	2 810	3 157	3 044	2 808	2 882
Trespassing Accidents	87	112	84	82	105	82	177	109

* Figures do not include right-of-way fires.

Source: Summary of Accidents - Incidents Reported to the Canadian Transport Commission. Year 1981 Prepared for the Railway Transport Committee by the Safety and Services Branch, Ottawa, 1982.

Table 2

RAILWAY ACCIDENTS AND INCIDENTS INVOLVING DANGEROUS COMMODITIES 1974 - 82

Incidents involving the transportation of dangerous commodities other than in train accidents.

	1974	1975	1976	1977	1978	1979	1980	1981
Total Incidents	37	31	31	30	47	51	107	157
Casualties								
killed	-	-	-	-	-	-	-	-
injured	-	-	8	1	1	6	23	1

Train accidents where dangerous commodities made up all or a portion of a train consist and were directly involved in a mishap which resulted in loss of lading, damage to equipment, loss of man hours or contamination of the environment.

		1974	1975	1976	1977	1978	1979	1980	1981
a)	Derailments	31	30	33	36	43	42	65	131
	Casualties								
	killed	-	-	-	-	-	-	-	-
	injured	-	-	-	-	7	2	-	1
b)	Collisions	7	6	7	7	14	17	44	57
	Casualties								
	killed	-	-	-	-	-	-	-	-
	injured	-	-	-	-	-	-	-	-
c)	Crossings	2	-	3	1	-	2	11	3
	Casualties								
	killed	-	-	-	-	-	-	4	-
	injured	-	-	-	-	-	-	2	2

Source: Summary of Accidents - Incidents Reported to the Canadian Transport Commission. Year 1981. Prepared for the Railway Transport Committee by the Safety and Services Branch, Ottawa, 1982.

Table 3

EXPECTED AND RECORDED ACCIDENTS ON
MAIN LINE IN TORONTO CMA 1981

TYPE OF ACCIDENT	"EXPECTED"			RECORDED
	PROBABILITY ASSUMPTION			
	.005	.01	.047	
Collisions	0.5	1.0	0.16	2 (in Oakville Yard)
Crossings	0.02	0.05	0.05	0
Derailments	1.2	2.3	1.4	3
Product Releases	0.09	0.18	0.17	0
Total	1.71	3.35	1.61	5 (including 2 yard accidents)

Figure 5
FLOW CHART
OF DANGEROUS COMMODITY LOADS
CP RAIL

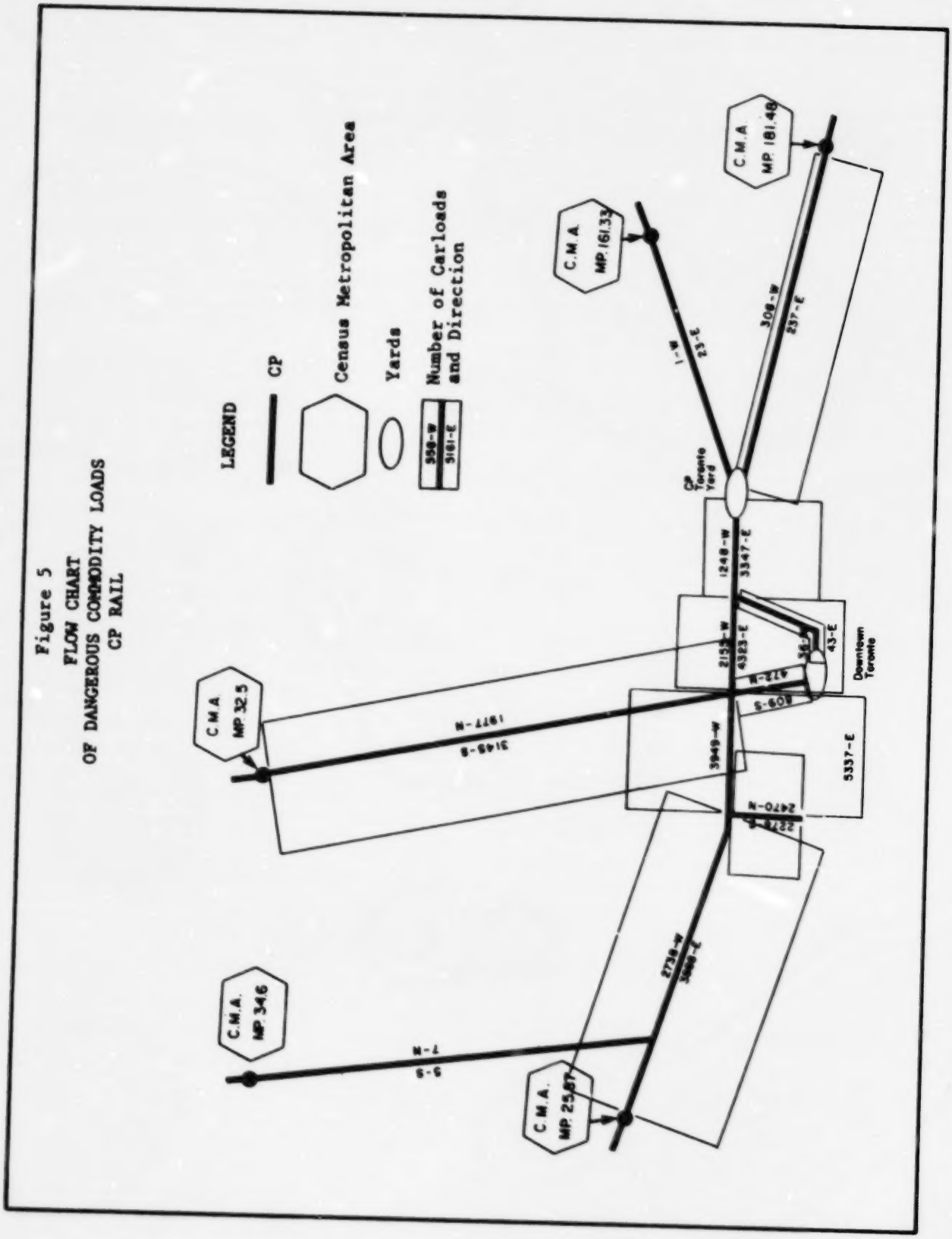


Figure 6

FLOW CHART
OF DANGEROUS COMMODITIES
CN RAIL

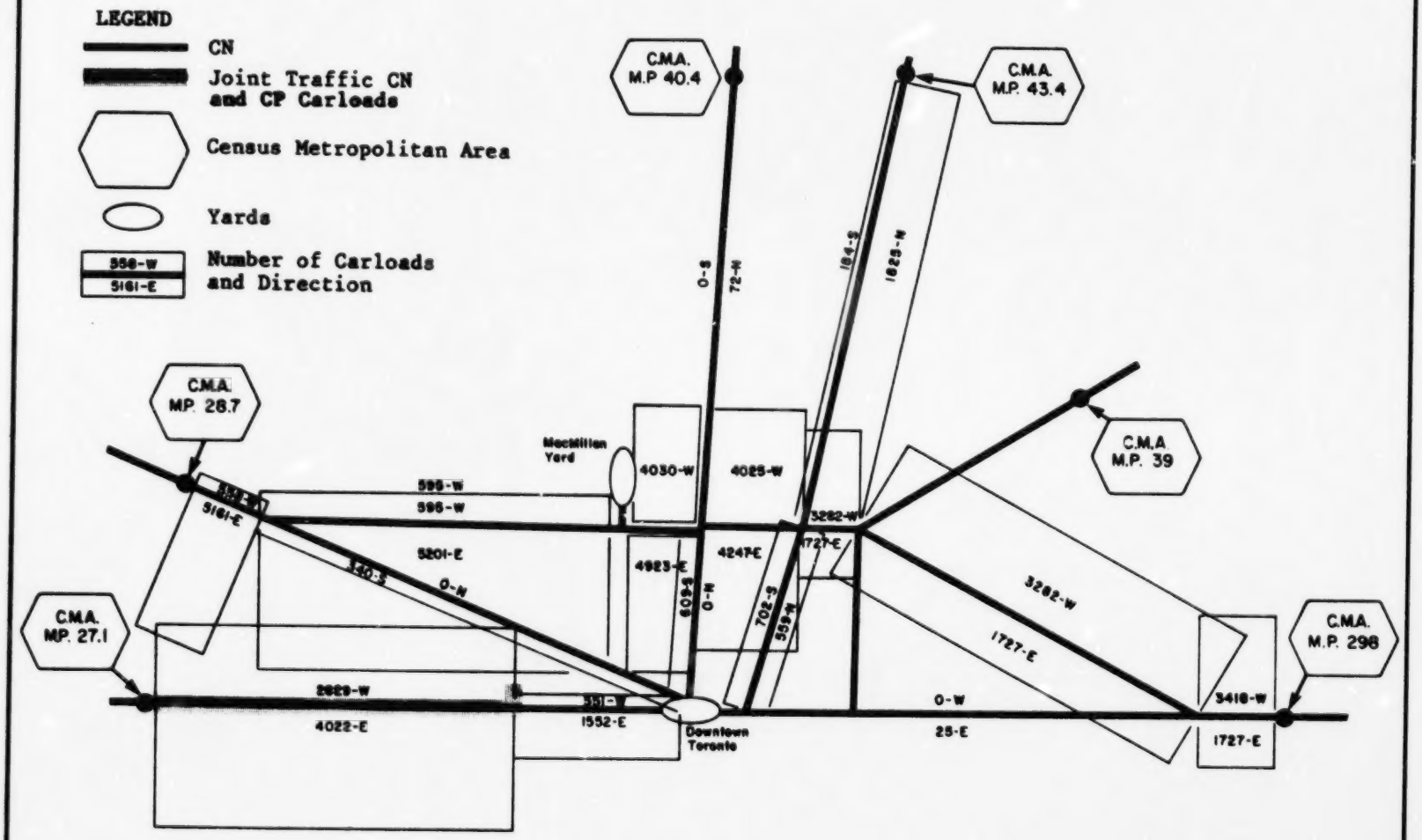


Figure 7

FREQUENCY OF CORRIDORS
BY RELATIVE RISK INDEX
INNER ZONE

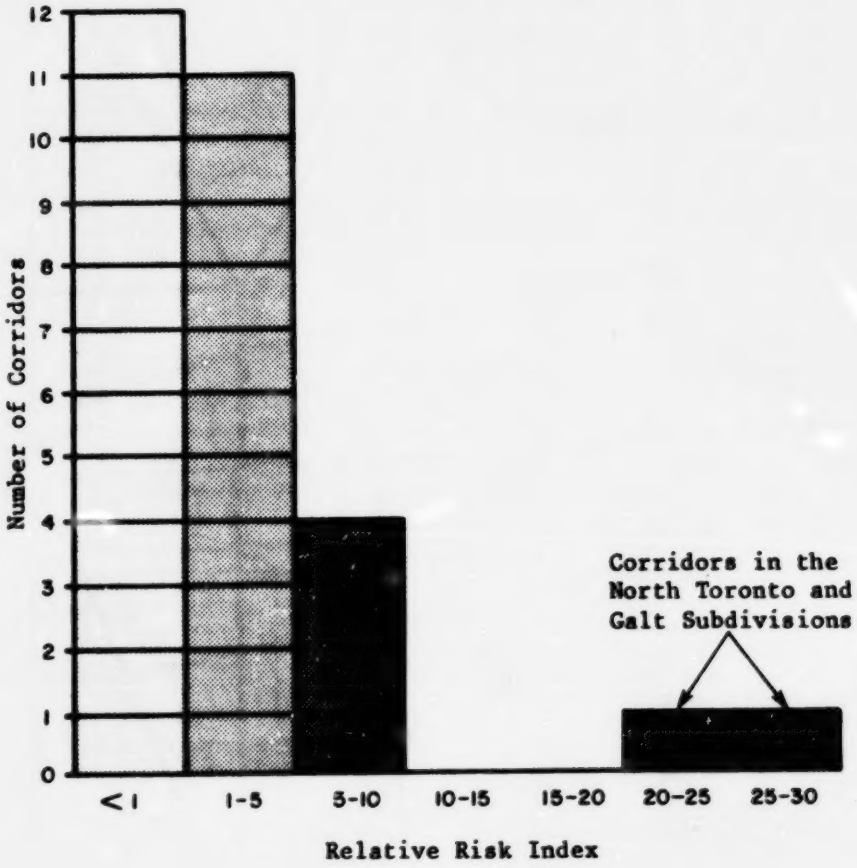


Figure 8

RELATIVE RISK INDEX BY CORRIDORS
INNER ZONE

From this analysis two conclusions emerged. If it is considered desirable to reduce risk further this can be achieved by rerouting some of the dangerous commodities from CP North Toronto subdivision onto the CN York subdivision. This would have the effect of lowering the risk by reducing the consequences of any accident that may occur.

By extension, an even more substantial reduction in risk could be achieved by building new railway lines around the city at some distance to the north, and thus separating the dangerous commodities from dense populations. The study concluded by recommending that feasibility studies be carried out to see if such radical alternatives would be technically feasible and economically justified.

Technical feasibility will no doubt be relatively easy to demonstrate. Economic justification will probably prove more difficult, simply because it will hinge upon the acceptability of high costs to reduce or prevent the occurrence of an unlikely catastrophe.

The methods of risk modelling, historical analysis, and relative risk as used in the Toronto study show that risk assessment is an important and necessary part of the development of a sound approach to the issue of risk in the transport field, especially perhaps the transport of dangerous goods. The limitations of the methods of analysis are also apparent. There need be no fear that risk analysis will replace the need for democratically elected or appointed decision-makers to make wise judgements on behalf of all Canadians. The study shows that risks can be substantially reduced by the rerouting of dangerous commodities, or railway relocation. The costs of either of these alternatives is likely to be very high when measured against probable loss of life on an average annual expected value basis. In addition, any decision which redistributes risk in order to reduce aggregate social risk faces the likelihood of implacable opposition from those who are asked to bear increased risk, however small it might be, for the general good.

Risk assessment methods, thus, help to clarify the choices available to decision-makers and to show some of the implications of whatever choice is made. The methods are not a substitute for good judgement and political choice.

BIBLIOGRAPHY

Burton, I. and Post, K. The Transport of Dangerous Commodities by Rail in the Toronto Census Metropolitan Area: A Preliminary Assessment of Risk. Ottawa: Railway Transport Committee, Canadian Transport Commission, 1983.

Burton, I., Whyte, A.V. and Victor, P. Final Report of the Mississauga Evacuation. Toronto: Ontario Ministry of the Solicitor-General, 1981.

Grange, The Hon. Mr. Justice Samuel G.M. Report of the Mississauga Railway Accident Inquiry. Ottawa: Minister of Supply and Services Canada, 1981.

Kates, R.W. Risk Assessment of Environmental Hazard, Scope 8. Chichester: John Wiley and Sons, 1978.

Pacific Northwest Laboratory. An Assessment of the Risk of Transporting Liquid Chlorine by Rail PNL-3376. Andrews, W.B. et al. Richland, Washington, 1980A.

Pacific Northwest Laboratory. An Assessment of the Risk of Transporting Propane by Truck and Train PNL-3308. Geffen, C.A. et al. Richland, Washington, 1980B.

Risk Analysis: An International Journal

Whyte, A.V. and Burton, I. Environmental Risk Assessment, Scope 15. Chichester: John Wiley and Sons, 1979.